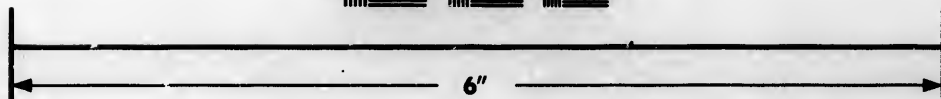
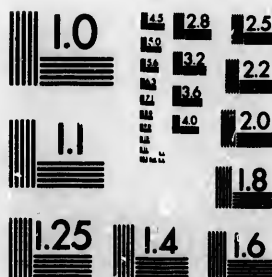


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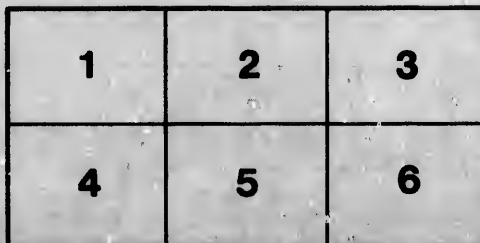
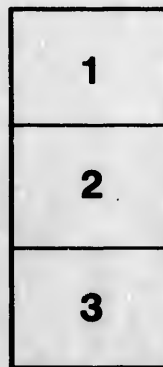
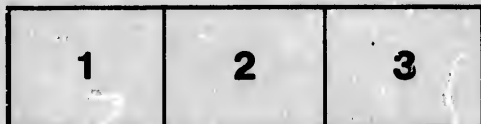
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# REPORT OF A CASE,

TRIED AT

## ALBERT CIRCUIT,

1852,

BEFORE HIS HONOR JUDGE WILMOT,

AND A SPECIAL JURY.

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ABRAHAM GESNER

vs.

WILLIAM CAIRNS.

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Copied from the Judge's Notes.

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SAINT JOHN, N. B.

PRINTED BY WILLIAM L. AVERY.

1853.

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 ON WHICH EXAMINATION OF EACH BEGINS.**

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# REPORT.

ALBERT COUNTY, 20th JULY, 1852.

Abraham Gesner }  
against } TRESPASS *quare clausum fregit.*  
William Cairns. }

FIRST COUNT. Upon the statute of Henry the 6th, intituled "Duty of Justices of the Peace where land is entered upon or obtained by force," and at time of grievances plaintiff was possessed of close in Hillsborough, as tenant to James Steves, Dawson Steves, and J. L. B. Steves, for the period of ninety nine years from the 24th day of December, A. D. 1850, and plaintiff being so possessed, defendant not regarding the statute, on the 21st January, A. D. 1851, *vie et armis*, broke and entered and forcibly put out, &c.

SECOND COUNT. For Expulsion.

THIRD COUNT. *Quare clausum fregit.* 1st January, A. D. 1851, in the parish of Hillsborough, &c., tore up and spoiled the earth, and cut down trees.

FOURTH COUNT. For Expulsion.

FIFTH COUNT. Broke and entered, &c., and sunk shafts, and dug up soil, and asphaltum 1000 tons, and converted &c.

SIXTH COUNT. Broke and entered a certain asphaltum mine.

SEVENTH COUNT. *Aspertavit*, 1000 tons asphaltum.

PLEA—GENERAL ISSUE.

*Special Notice,*

That Queen possessed of all the mines &c. in the said closes, and by licence of 11th January, 1850, to Peter Duffy and John Duffy, &c., for twenty five years—and that Duffys assigned to defendant all their rights, and they ought to have necessary way over the closes for enjoyment of the mines and buildings necessary; and that plaintiff had entered mines, and was carrying away when defendant opposed him.

## Mr. Smith opens the plaintiff's case.

Two first counts are for forcible entry. 3d. *Quare clausum fregit*. We will show title to the land. One question will be whether asphaltum or coal. To four acres we have right by title and possession. Plaintiff in quiet possession when defendant and others came and drove him off. They have been from time to time removing asphaltum, and other substances which we are entitled to.

The deposition of R. C. Taylor will be read. He says it is not coal, but asphaltum.

### EVIDENCE ON THE PART OF THE PLAINTIFF.

1st. An assignment of a lease from Christopher Milner to Abraham Gesner, of date 27th December, 1850. Recited a lease from Dawson Steves to Milner, of the bitumen, asphaltum, &c., on sixty six acres, for twenty one years, at one shilling per ton on asphaltum, on land heretofore granted to one John Martin, and also recites a lease from Robert L. Steves, and also a conveyance of four acres from Dawson Steves, James Steves, and J. L. B. Steves: consideration £4000, and all assigned to Gesner with a covenant for good title. Proved 9th January, 1851.

2d. An indenture of lease, dated 24th December, 1850, from James Steves, Dawson Steves, and J. L. B. Steves, to Christopher Milner: consideration 1s.—granted, leased tract, &c., piece, lying southerly of Robert Steves's lot, being part of lot commencing on south line of Reuben Steves, north corner of D. Steves' land, thence south up the vault on said Dawson Steves' line until it strikes the north west corner of James Steves' land, thence following the side line between James and John Steves, an easterly course 100 yards, thence northerly till it strikes said Reuben Steves' land 100 yards from first bound, and thence to place of beginning, containing about four acres—yearly rent of £10, and 1s. per chaldron on bitumen or other treasures of the earth. Acknowledged 24th, and registered 27th December, 1850.

3d. Indenture 24th December, 1850. John Steves, to James, Dawson, and J. L. B. Steves, in fee. Consideration 1s. Same description as preceding. Acknowledged 24th, registered 27th December, 1850.

4th. Deed from George Steves, and Eliza his wife, to John Steves, 16th March, 1848: consideration £80; two pieces land of a lot granted to George Steves, as described as lot No. 1, beginning at a hollow or vault on west side of grant, thence following brook up

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stream for nine chains and fifty links at right angles with side line, thence east, parallel to side line, to edge of meadow, thence north 20 east to side line of grant, thence west on side line to first bound, 54 acres. Acknowledged 27th December, 1850, registered 27th December, 1850.

5th. Grant from the Crown to George Steves, a lot, No. 1, in second range, west side of Petit River, abutted as follows, &c., except &c. all coals, and also all gold and silver, and other mines and minerals. Dated 8th March, 1813. Plan annexed.

*John Edgitt, Senior--sworn on voire dire.*

In chief. I know the parties. I know a lot granted to George Steves, No. 1. I have known the lot for 15 years back. I know the asphaltum mines. [Kerr reads description from deed—George Steves to John Steves.] I know that these 54 acres are on George Steves' lot, No. 1. [Kerr reads description of four acres.] I know that piece—the mines are in that piece. I think Gesner was there in 1839, making a Geological Survey. I was then with him at Frederick's brook; we saw pieces in the brook, but not the out-cropping. We made a fire at that time out of bituminous rock or shale—it was not this material. Milner was at my place at the time he purchased. Cairns was then in the place. I was told then that Allison had a lease, and that Cairns was concerned with him. All that time Cairns had nothing to do with this place that I was aware of. Cairns was searching, and I wrote to him, and he told me he had received the letter, and I wrote him after that again, and he said he had received my letter: this was before the purchase from Duffys. I had a conversation at my house about Milner's purchase. I told him he had better secure the rights of entry by lease or purchase—that I thought the lease did not give him the right of entry. He said he could dig and go where he pleased; he would ask, and if leave was refused him, twelve men could settle it. I saw shaft when Duffys worked it, and shortly after Cairns went there. Duffys then had from 200 to 300 chaldrons at the pit's mouth. Gesner's men were working to the eastward of the other party a short distance, but had not raised any coal or asphaltum at that time. I think Cairns had not raised any then, but was getting ready. Out house rough boarded, where men lived, that was on ground described as Gesner's. Cairns may have been there a week before I saw him there. I have seen asphaltum. I have melted it in coal tar, oil, and turpentine, and in a close vessel without any solvent—an iron tea kettle is best. I used it last year melted in coal tar for paying a boat's bottom. The piece I melted in coal tar I got

from Duffly's. I tried the first experiment the last of May, 1851. I have tried it for boots to make them waterproof. I melted that in oil boiled. I think broken up small, it would melt in less than half an hour. Just after I finished my boat, Professor Taylor and Dr. Robb were there. Taylor is dead now. They were employed professionally at the mines: this was the latter part of May, 1851. They lodged at my house while in the County. I gave them specimens which I got out of the mines. Dr. Robb saw me finishing my boat, and I gave him specimens of it after it had hardened. I have put it on barrel staves and shingles. I have tried it at the flame of a candle, and it will drop after the *outer crust* is removed. It first blazes and burns, and forms a crust, and if you knock that off it will run by a candle. It is good to kindle fire with, and is very inflammable. It is harder after cooling than before. I have melted and poured it into a bottle: this is a piece so treated, mixed with coal tar, which I had for paying the boat. This is a piece mixed last Saturday, half coal tar. This is another piece melted in coal tar, half and half as to bulk. [Several pieces of the same mixture were produced by the witness.] During the adjournment I put a small piece into this bottle, and put some turpentine in, and dissolved it into this liquid over the flame of a candle. This is mixed with linseed oil, it is quite soft—it was of pieces cut from this that I made this fluid in spirits of turpentine. I am 63 years of age. I have been all my life in this country. I never heard name of asphaltum until this discovered. I have seen the material years ago, but did not know it as asphaltum. Some time in 1849, I think, that the asphaltum was discovered.

*Cross-examined by Gray.\**

I have heard for many years past that there was coal up Frederick's brook—fifteen years ago. I was under the impression there was coal there from finding such an article as this. When I was with Gesner in 1839 or 1842, we found an article called bituminous rock. Gesner told me that this article was not coal, but that the other was. He did not say what it was, he said some called it jet. He was then Provincial Geologist—he did not tell me it was a valuable article. The other kind which we burnt was abundant all round—it was a brownish color: we did not burn this kind. I did not weigh the coal tar or the other. I mixed paint oil and coal about equal, and made this, and then I melted it in turpentine. The coal I used I got from

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\* The names of the counsel who took the different examinations not having been always taken down, they have been supplied as far as possible by one of the defendant's counsel.

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the mines in November or December, 1851. I tried an experiment with some brought by my team, and some in paying the boat: it was covered with specks. If sand were stirred up through boiling tar it might be put on. I broke it up fine, not to a powder, but to small pieces. When I commenced the last experiment there was no one present. Isaac Grose, Jr., came in after I had done. Yesterday morning I tried to melt some by heat, and it went to coke. If you melt asphaltum and cool it, it is the same, but what I burned yesterday took fire and left coke. *Coke can be made by asphaltum.* Cairns had not purchased when Milner was there about the bargain. When Milner and Cairns were looking about, Allison had a lease in Westmorland. Duffys worked all the summer of 1850. It was very early in January, 1851, when Gesner's men were at work. Cairns went to St. John, and came back and went to work: this was the same time as I referred to this morning.

*Re-examined by Kerr.*

Gesner did not tell me whether it was or was not coal, but he said some called it jet, and others lignite I think. I am sure what I used came out of Duffys mines.

*John Eslee.*

I know C. Milner and William Cairns. I was employed by C. Milner to go into the woods. I made a piece of a fence by his directions on a line between land that Robert Steves owned and land owned by James, Dawson and John. I did not make the fence as far as he directed. I got lame and quit. I went back and saw Cairns. I was there six days. Milner paid me. While I was there William Cairns, Barber, and several others came. I told them Milner put me there to forbid them, and Cairns said to tell Mr. Milner he came there by authority of the Crown; and he went on—there were eight or ten at that time. I was there two or three days after that. I did not try to keep them out. He told me not to use any violent means. Some went to work digging about mines. I think Cairns went to work, and Brown his foreman. They worked on land about the pit. I think I saw one of the men cut a tree for firewood. It was between Christmas and New Year's, a year ago. It was the day after Christmas 1850, that I went, and I left before New Year's. Cairns had men putting up a chimney in a cook-house.

*Re-examined by the Attorney General.*

I knew the ground before Cairns went there. Duffys worked there before. When I went out I saw where Duffys had been at work. I

did not see Cairns when I went out, but two or three of Duffys men were there bailing water out of the pit. This was the first day I went out; it was that day I saw Cairns and his party; the fence was from six to ten rods from where Duffys men were at work; the fence I put up ran about east and west, and ran across the road leading to the pit: Milner directed me to leave the road open to the pit. I understood I was to make a fence around the four acres, There were trees blazed round where I was to make the fence. I was not present at the running of the lines. I think I knew the line between the Steves'. Cairns did not forbid me doing anything or interrupt me—he said he came by authority of the Crown and said nothing else. Milner came out and sent for me. Cairns' party commenced cutting away snow and sticks, and making ready for sinking a hole. I think one of Duffys men remained working for Cairns. Cairns and his party remained carrying on mining operations. I did not see Cairns' men do anything except for mining operations. I had no quarrelling or squabbling with any of them. I was there once or twice through the Winter. I saw Cairns and Brown, and their men at work there. I am satisfied Cairns was not out to work before I went out there. I made ten or fifteen rods, or eight rods anyway. I think I was theretwo or three days before Cairns came out. Duffys men were living at that time in the cook house, and there was a shed over the pit, the same as now, to work the horses in. I am pretty sure the stick I saw cut was on the four acres—a hardwood stick near the line, close by the cook house. Several other buildings have been put up since. The cook house was on the four acres.

*Re-examined by Kerr.*

I had worked out there for George Steves, and I knew the land. I knew the dividing line and I worked on that line, making the fence. I don't know that I ever saw Duffys at work before I went out for Milner there: there were eight hands of Duffys there, not digging coals but bailing water. I think I was out one Sunday the winter before, and saw Duffys men there.

*Ward Edgett—voire dire.*

In Chief. I know the parties. I know the place where asphaltum is got, since 1849. I was in Gesner's employ in January, 1851, on that place. John Robertson, his son, myself, Mr. Binney, Dawson and James Steves. Dawson Steves put Binney and Dr. Gesner's men in possession. Binney was acting as agent for Gesner. We went to work. He showed us where the land was, and we went to work on the four acre lot so called. There was snow on the ground:

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it was the 9th January, 1851. We went to work clearing away the snow, and for mining. Cairns, and Brown, and Workman, came the first day while we were at work—where we commenced was 300 or 400 feet from where Duffys worked, and there we commenced digging for asphaltum. When Cairns came he forbid us working there—he forbid Binney or any of his men; and Binney said he would take the same opportunity of forbidding him. Cairns said he was aware he himself was a trespasser. The four acre lot was not disputed then. We continued on working, and next day Cairns, Wright, Botsford and Workman came, and forbid again. We still worked on. Binney was not there. We worked on until the 21st January, and had raised about half a chaldron. Cairns came and asked if we would give up possession of the place where we were working, and we said no. Myself, Robertson, George Bowman, John Bowman and Stillman Downie were together, and he said he would drive us off by force. He went back, and returned with 23 men, and we had to leave or do worse. Cairns ordered the men several times to come out of the pit: they came out and left in consequence of his warning. As one of our men was winding up, the windlass hook flew round, and Cairns said there would be bloodshed: they boarded up the pit and left men to watch—they had one gun. I should not like to have gone back. I made an attempt one day to go in, and they told me to keep clear. At the same time they were working at their own place. When I came back, the half chaldron we had raised was taken away. They kept on raising, I can't tell how much, till the 4th February. A team could haul from one to one and a half chaldrons at a load—and haul one or two loads a day, and with the teams they had could haul 10 to 20 loads a day: in all they hauled 10 days before the 4th February, making about 200 chaldrons. There were different roads for hauling timber. Cairns' men kept cutting and hauling timber for barring up the pit. I don't know where they cut. The asphaltum hauled out was shipped away by Cairns. I have seen asphaltum melted. I assisted my father last Saturday. The material he had came from the mines. On Saturday last I dissolved some equal parts of paint oil and that, and boiled it ten or fifteen minutes, when it was dissolved. We turned it upside down, and every thing ran out—there was nothing left behind. I saw my father put asphaltum in a bottle, and melt it in oil. Cairns commenced putting up a building on the four acre lot before the 4th February, for a blacksmith's shop. I was frequently back after the 21st. The soil has to be broken to sink a pit. I think our shaft was six feet by twelve. The one they sunk was about six by twelve too. Can't say how deep. If the



timbers were to give way, the soil would fall in. A great deal of shale is taken out and piled round, so that the land can't be tilled. I should judge there was an acre lumbered up and broken altogether.

*Cross-examined.*

In 1849, Duffy commenced work in g. Dawson Steves shewed us where the line was between him and Robert Steves. The Robert Steves line is to the east of the shaft. Cairns said he forbid them raising coals or minerals of any kind, or working on the land. We went to raise minerals. Cairns told us not to go nigh the pit, but he did not tell us to go off the four acres. When Cairns said he was aware he was a trespasser, Botsford, Wright and others, were present. Wright read from a paper; he said it was their claim from Duffys. Cairns had hay piled there. The material we used came out of the shop, out of a pile which came from the mines. I put it in a pot and it melted before the pot became red hot—oil mixed with it.

*Re-examined.*

I have melted it in a candle. At first a shell is formed; knock that off, and it runs. We found Cairns' men working when we went in on the 9th January.

*By Judge.*

When applied to a candle, it snaps and flies off. I have seen it used in a forge, and blacksmith's work done by it.

*Stephen Binney.*

I know both parties. I know the place in the lease from Steves to Milner. I was on the ground the 9th January, 1850. I called on them to go and point out the land, so I could select the spot to work. [Attorney General objects to any act of Steves' after he parted with the title. Judge admits evidence of act of Steves in pointing out bounds of the lot.] I went by instructions of Gesner. James Steves lives on the right side of the road to the mines, Dawson lives on the main road to the settlement, and John lives on the main post road: they went and showed me the line between Robert and Dawson, and James Steves. I saw lines. The asphaltum mines were pointed out on James and Dawson Steves', or what is termed the four acre lot. After that (9th January, 1851,) I took in Robertson, his son, Ward Edgitt, and one or two others. I think five in all commenced digging that day—shovelled off snow and chopped down trees; it was about 100 yards from the slope where Duffys worked, and where Cairns' party were then at work making preparations for raising

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asphaltum. While my men were at work, Cairns came in an excited manner, and before he got to us called out and forbid them digging. I turned round and told him we should continue to dig till we came to gold, silver, or coal, which we should leave for him, but any other substance I should dig and carry away. I then said I took that opportunity of forbidding him and any of his men from trespassing on Dr. Gesner. He said he was aware he was a trespasser. I gave him to understand I was there as agent of Dr. Gesner, who represented the owners of the soil. I went away the same afternoon or the next day, and I left orders for picks &c., for raising, and when I came back the men were off: the expense of the men and the articles furnished would not exceed £25. It was about the last of December, 1850, when Milner purchased. I met Cairns going to Saint John. Milner was present. Shortly after Milner purchased from the Steves'. Cairns was aware of Milner's purchase, but he had not then bought from Duffy the four acre lot. Cairns and Milner had a long discussion about what was a mineral. We were on board of the steamer at Dorchester Island, I think near the middle of December, and before Milner purchased the four acre lot. Milner did not keep the matter a secret at all; he previously offered his rights to me.

*Examined by Gray.*

Cairns' men were at work when I went. I had not had possession before for Gesner. The men were forbidden to work. I had forwarded a letter to Duffy from Gesner for license: an inquiry was made for Gesner. I had no authority to purchase for Gesner. In December I was negotiating for Gesner to purchase a warrantee title. I had a conversation with Duffys at Saint John one day. I had a communication from this County, that Cairns was then purchasing the mines. I then went and asked them whether their license was sold, and I asked if open to bargain for Gesner. I telegraphed to Gesner. The wires down—no answer till the 12th, when it came. They had been at my quarters before it arrived—it was, "I will give £5250, warrantee title, one-third down. 12th December." I read it to Duffys same day, and I saw nothing more of them until John was waiting at the Hotel next evening to see me. He then told me the bargain was off with Cairns. I put the question to Duffy—if your bargain is broken off and you wish me to remain, I will stay? I telegraphed to Gesner that Cairns had offered £5000, and he answered give £5250. Nothing would have induced me to give that sum without the right of soil. I advised Milner not twenty four hours before it was done to get a lease from Steves.

Witness offers a copy of a telegraphic communication—Allison to Gesner—Gray objects.

16th December, 1850. Allison to Gesner, "Do not conclude with Duffy till you hear from me. E. Allison."

Court adjourned.

### WEDNESDAY MORNING, 10 o'clock.

#### *S. Binney's cross-examination continued.*

When I shewed Duffy, Gesner's offer, he expressed regret it had not come sooner, as he had made arrangements with Cairns, and in a great measure concluded—this was on the 12th. In the evening of the 13th, Duffy called at the Saint John Hotel, and said the bargain was broken off, and wished me to carry out arrangements with Gesner, and on the 14th I telegraphed to Gesner, that Duffys had concluded to sell to him, and for him to meet them at the Bend on the Thursday following, and on the 16th I received this telegraph from Gesner, "All right, I will come by next mail." Peter came the evening before Thursday, at the Bend, and asked me to postpone the arrangement for a few days; and after he had left me, I heard he was on his way to Saint John, to complete an arrangement with Allison. I received a letter from New York, from Henry Gesner. After I heard the bargain had been closed, I asked Allison if he would part with a share to Gesner, and he led me to believe he would. I recommended Milner, on the 24th December, to get four acres from R. Steves. I knew Duffys had been mining on the four acre lot. The place where Dawson Steves pointed out the bounds, included the place where the mining operations were carried on.

#### *Re-examined by Kerr.*

I think Gesner had his first communication with Milner as early as October or November, for the purchase of his leases. I telegraphed to Gesner that I understood Allison had offered Duffys £5000. I got that impression from rumours in Saint John. There had been previous negotiations between Gesner and Milner, through me, for a purchase of the private rights on a large portion of the lease on which the four acres were situated. I mean the rights of the owner of the soil. I am aware there was an answer given to Allison's communication to Gesner—this is a copy in Gesner's handwriting. I mailed the original myself I think. I saw an answer from Allison to that letter. Gesner had it. Gesner remained at the Bend some days—more than a week. Gesner waited and received his reply at the Bend, and in the mean time negotiations made with Milner.

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Allison was making a bargain himself. Allison's answer to Gesner was that he had purchased it himself. Gesner practised no deception.

*John Robertson.*

I know the parties. Preside at Hillsborough. I have been in this County since 1850. I heard of mines. I have been a miner since eight years of age. I am 45, and was born in Scotland. I came to this Province twenty years ago. I was engaged in mining in a colliery in Scotland, in Baird's mines, and other coal mines, from eight years of age to 1832. I worked in Nova Scotia, in the Albion mines at Pictou. I worked there 17 or 18 years, I was in the United States five or six months. I was employed by Duffys when I first came, to set their mines agoing. I went there the 8th January, 1850: no mine there then: about three or four feet of the surface peeled off: appeared to me like anthracite coal. I told them it did not look like common coal. I asked Duffy if it blazed, he said yes. I said this does not look like a coal vein, for all the shale butts end on. I know the four acre lot: know Milner had a lease from Steves. I know the land and the boundaries. I know persons owning land around it. I first became acquainted with this lot in 1851. Binney hired me to work for Gesner on the four acre lot: this was the 8th or 9th of January, 1851. Binney, Ward Edgitt, Robert and Dawson, and James Steves, went out with me. I set men to shovel away the snow to sink a shaft. We had not worked long, when Cairns came and forbid us all from working and raising any of his minerals, or something to that effect. He said one could not stand for the other—that he would take us all. Binney then forbid him to come and molest any of his men from digging on the soil, and said we'll dig here, and if we find any coal, or gold or silver, we will leave it for Government, but whatever else we find we will take away. Binney went away; and there were five men besides myself. We dug down 17 feet to the top of shale, and then timbered up our shaft, and began to raise asphaltum: we had half a chaldron up when Cairns came up, and said you are raising my mineral. He looked at a piece, and said, if you give up possession and go away quietly, there will be no more about it. This was in January. He asked again if I could give up possession. I told him I could not. He asked Edgitt the same, and he answered he could not. He then said he would get his men and drive us off. He went and got twenty three men, and brought them with him, and drove us off. He took one side of the shaft, and ordered our men to come up. I told the men to fill the bucket. They came up, and I took the rope and put a half hitch on, and winding it up it flew over and nearly struck one of

Cairns' men, when he said, be civil young man or there will be blood-shed. Cairns then ordered Brown, his man, to take down the windlass, and I said, Mr. Cairns, I forbid you or any man from taking down my works. The rope was taken off and hid one side, and windlass too. He then ordered his men to cut boards and nail up the pit. As a man was nailing I forbid him. Cairns and his men remained there till they built a house over the pit, and a place for a man to stop in. We had raised about half a chaldron, and Brown ordered his men to wheel it away to the other mine. I forbid him wheeling it away, and he said he wished there was more. While they were working, our men worked too. I told them to make all tight. Cairns was there again next day with Brown, and asked me if I was waiting there to keep possession: he had men sitting round with arms. I said I was sitting there keeping possession; that he had driven my men out of the pit, and I was sitting there till the law put me in. Cairns said, if he thought I was keeping possession he would drive me further off. I said it was a strange law, to drive a man off his own property. When Brown forbid him, Cairns said he knew he was a trespasser, and he was prepared to pay for it. I do not consider it coal. I never saw coal like it. Never saw coal in such a formation: there is no regularity in the formation—there is no roof; if it had, the shales would be parallel to the vein, but the shales lie sometimes vertical and sometimes horizontal. I never saw a coal formation like it; the roof and floor of a coal seam are always parallel to coal. Some coal has fire clay as floor, and some shales, and fire clay contains plants called stigmaria. Every seam of coal is generally uniform in thickness. This formation has none of the appearances which coal beds have—it has neither a coal roof, nor a coal floor, and is not uniform in thickness, but it varies. I have seen it not two inches thick, and I have seen it fourteen feet. I have seen a good many veins in different directions—small veins. Coal never runs in such a way. It varies in its course. A person cannot depend upon its course for a distance of twenty feet, which is not the case with coal; the veins go off at right angles, which is not the case with coal: the roof and floor of coal mines are like the bark of a tree. It does not break up like coal. All coal has a cleavage one way; this has not. I have discovered some soft asphaltum in that neighborhood. These are the specimens; they were found in this Province, in the neighborhood of the mines: they are soft. This is another specimen called petrolium. These specimens are in their natural state, as when found. I have seen a good many springs of naphtha in the vicinity of the mines. I have tried a good many expe-

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riments : first was, I melted some to put on my boots. I melted that in hogs fat: the next time in linseed oil. Many people would scarcely believe it was the stuff. I have melted it in its natural state. I can boil it in a kettle without any solvent. I saw it melted in coal tar, and saw Edgitt's boat graved with it. I have tried it with a candle: it will melt and drop. I have tried it before a great many persons. After it cools it presents the same appearance, when broken, as from the mine; it is not so with coal: it will not melt—it will burn away. This asphaltum is lighter than coal. I have seen it float on the water in the mines. The soft specimens will float too. When I first went to work, Cairns was there on the four acre lot, working their mine—sinking a shaft. The ground was a good deal encumbered with rubbish; they were cutting timber and making ditches and drains. They were raising daily from the 9th to the 21st January. We continued on there till the month of May. They hauled out to the shore. Some days more teams, some days less. I have known them to raise 16, 18, and 20 chaldrons in 12 hours, and they hauled it out as it was raised; they worked night and day. I would say 200 chaldrons were raised from the 9th to the 21st. I have heard that it was sold at 1s. 6d. a bushel at the mines. Duffys sold it at the mines for 15s. a chaldron. Cairns said he would ask more.

*Examined by Attorney General.*

My information is derived from practice as a miner. I have been in Dr. Gesner's employ since 1851. I worked about three months for Duffys. I might have been at work an hour or two when Cairns came up; he forbid us to dig or raise any of his minerals. I did not hear him say we might do what we liked with the soil. Binney said, "We will leave gold, silver and coal for you and the Government, but whatever substance else we will take." Mr. Wright came one day and threw off his coat, and said don't think we have come here without a title, and commenced reading. He asked me if I was digging for coal. I told him no, I was digging for asphaltum. After Cairns forbid us we continued digging in the shale, and there was no other interference until after we had raised about half a chaldron, when Cairns said he thought it was high time for me to stop, and if I would give up possession and go away quietly, there would be no more about it. Had Cairns not interfered I should have gone on with the work. I know the bounds of the four acre lot. The shaft we were sinking would have come into the same vein Cairns was working. I did not come to the roof of their level. After we wrought down, we went down on Duffys gangway. Cairns was not working in

Duffys levels. We remained there after Cairns ordered us out of the shaft, and worked. Next day he told us if he thought we were remaining to keep possession, he would drive us off. I continued on the ground until the month of May. After they shut up the shaft they did no other act to us, and I remained at my work, and they did not interfere with us. I had nothing to do with the soil. I went home at night and returned in the morning. I left men there with a double barrelled gun and a brace of pistols. I left on my master's orders, in May: [*looks at bright piece*—this is asphaltum, it is not coal; it is black like anthracite coal. I call it asphaltum, because it melts. This will melt and drop if held in a candle. This is the same kind (bright): will melt in a tea kettle, and you can pour it out. Fill the kettle half full, and it will not melt till it is flowing over into the fire. These (soft specimens) did not come from the same vein: about three miles from the Hillsborough mine—more than three miles in the same course. I consider the substances are the same—the one harder than the other. I got the petrolium in another place: it is distilled from the others. I will not swear the soft specimens were less than ten miles from the mines. I think it is less than ten miles from the mines: it might be more, it might be less. I can find it in more places than one. I found the first soft specimens last Winter, 1851. I found the marked specimen in the winter of 1851. I would not like to swear that I found any of these soft specimens in Albert, but I have found some like them in this County. I collect specimens. All the soft specimens I have collected since I came to this Province. *Gesner marked this: he wrote the label after it went to Halifax.* I will not swear it came from Hillsborough. It came from the Petitcodiac river, on the other side. *I don't know why Gesner marked Hillsborough on the specimen.* I have traced shales formation more than 10 miles, but not out-cropping of veins. I know Ayres' farm in Westmorland. There is a petrolium spring there. I found the petrolium there: it is not the same as the other. I got some soft specimens on this side of the river. I know Stony creek—I got some from there. This large piece will sink in water, but in small pieces it will swim. I have pulverized some of it, and it is then as black as this. Last Saturday week I went up to Stony creek, and got some pieces of soft asphaltum for the purposes of this trial. I can't say these are part—a part of them: they may, or may not be. I was ordered to give it to the men who came for it. I considered it asphaltum then. Duffy sold it 15s. a chaldron. I could not sell it for any other thing than coal. A good deal was sold to blacksmiths. I do not recollect that about twelve months ago, I told any person at Stony Creek that this was

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cannel coal. I never said on any occasion to any person within the last twelve months that this was pure cannel coal, to the best of my recollection. I think 35 to 40 is the highest angle of coal stratum I ever worked in. I believe there are some higher. I was in anthracite coal mines in the States. Some of them vertical—similar to this.

*Re-examined by Kerr.*

I did not endeavour to conceal the place from any suggestions of Dr. Gesner. I don't know of my own knowledge who put the label on this specimen. I sent it to Henry Gesner to send to Halifax for Dr. Gesner. Next time I saw it was in Halifax. I have some more specimens at Mr. Calhoun's in a box. There are two or three places where this comes from. This piece came from Stony creek, on this side of the river. [Kerr produces a box full of specimens on re-examination, and Attorney General objects to their production at this stage of proceeding. Judge refuses to allow them in evidence.] I think this came from Stony creek (my stamp). When I spoke of neighbourhood of mines, I meant the neighbourhood of the course of the vein. Take about a N. N. E. course from the mines, and it will bring you to the place where the soft specimen is found. That is what I meant by neighbourhood in a north west course: about a mile I found soft specimens. [Attorney General objects to any re-examination, except as to specimens before the Court. Gray—"The difficulty could have been obviated by themselves." Judge allows the question "As to where soft specimens collected."] Some soft specimens I collected about a mile from the mines in the summer of 1851—a few pieces. I shewed them to John Edgitt: not in range of the same vein, but to the north west of the mines. I could take a man to that place yet. I had no other motive for concealment, but to preserve the secret of my discovery. The shaft I sunk, struck to the old level abandoned by Duffys, and not the slope in which Cairns' men were working. We went to the mine of asphaltum, and when stopped by defendant we ceased working, and I remained to watch defendant, and take an account of the materials taken away by defendant.

*By the Court.*—The kettle was not at a red heat.

*John Robertson, Junior.*

I am a son of the last witness. I know the mines since 1851. I was in the employ of John Duffy, in the same place as Cairns is now at work. I worked two months and six days. I was employed by Duffy in January, 1850, and worked till March, and we all left. We came back in April or May from Pictou, and went to work for Duffy



in August. We did not go to the same place, but at the slope. I know Duffys level, I worked in it; but after I came back in August, the back part of it was caved in. We worked at the slope about 40 yards from there. After I left Duffys, I was working for Foulis. Duffys left about 1st January following. They had the slope down about 100 feet, which would make 50 feet perpendicular. It was called coal by some, and asphaltum by others. I was there when Ester was there fencing a four acre lot. No one hindered him while making a fence. I heard Ester forbid Cairns going on the four acre lot. Cairns said "quite so, I mean to go ahead." He did go ahead. I was with Binney there. We went to work the 9th January. We commenced digging 30 or 40 yards from where they were digging. We came down to the asphaltum, and had we gone far enough, we would have come to Duffys level. We had taken out about half a chaldron, when men were out to wheel it away. Cairns came himself, and forbid Binney from raising any of his mineral. Binney said, I take the privilege of forbidding you from molesting my men. About the last of January, I was in the pit when they came. I was ordered out by Cairns: he had 22 men. We left because we were forced to leave by the men. Cairns said "come up out of that." We then left off working at the asphaltum. Cairns sent men to close up our works. Cairns came and said, are you staying here to keep possession of the shaft: my father said, he was keeping possession of the land. Cairns said if they were keeping possession of the shaft, he would be obliged to take a step further. Cairns' men had a gun and a brace of pistols. I remained with my father till the 1st May. He was keeping an account of haulers' names and the amount of stuff hauled. I can't say how many teams there: they would haul 30 to 35 chaldrons a day. They would take out during the month of January, from the 9th January to 4th February, 15 to 20 chaldrons a day for 22 working days. I was with my father when he got this at Stony Creek (the stone specimen), about a year ago this summer. We were exploring: to the best of my knowledge this is it. When we first took it out the black part appeared as hard as the other, and flakes came off and floated on the water, and after exposure it became soft. To the best of my knowledge this belongs to the same place as the other. The Stony Creek I mean was on this side. My father got the pieces I saw, on the other side of the river. I saw specimens like this petroleum got at Duffys place, about four miles from the mines. This came from the Hillsborough mines (the shining piece). I know where this came from. I have taken pieces of the same sort from Stony Creek or Peck's Creek on this side, one and

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a half or two miles from the mines : it puts into Weldon's Creek. I could go to the same place now. I last Winter broke up some, and put it into grease, and melted it, and put it on my shoes. This will melt, for I have melted pieces like it, which I got out of the mine. I have melted it in the blaze of a lamp. It will run through the crust. I melted some in a tea kettle. I would put a quart of this in a tea kettle, which would hold a gallon, and it would boil up and fill the kettle. I saw my father boil some in a kettle. I have seen this box before : it is my father's. He got the box, and put the specimens in it. I don't know who brought it down, but my father brought it out from his house : some of them got a year ago. It might be one and a half miles from the mines, where we got some specimens, about one quarter of a mile below Bowman's mill—not on a range with mines, but to the north west.

*Cross-examined.*

I am 18 years old. We got the soft specimens in the creek among rocks. To best of my knowledge, I saw my father get these, and to the best of my knowledge one came from Peck's, and one from Stony Creek. They got soft after a while. The bright piece does not grow soft. After the melted part poured out of the tea kettle, there was something like a crust in the kettle, same as what was poured out. What was in the kettle got harder from the heat I suppose. The longer you boil it, the harder it gets. I believe so. There is a high range of hills between Peck's creek and where the mines are. If our shaft left open and filled with water, I don't know but what water would run through. I saw the water come down overhead. I don't doubt the water would have run down through the coal. Cairns said "I forbid you touching or molesting any of my minerals." I knew he meant the thing he called coal. We did not know who was the right owner of the black stuff. I knew the land was Mr. Gesner's. My father was employed to dig the asphaltum. The parties were disputing about the black stuff. Cairns said to come up out of that, and not be digging his coal. There was some of the stuff raised when Cairns bought the mines, perhaps 100 chaldrons, perhaps not so much. There were teams drawing for Duffy and Cairns too. The two piles were not far apart. My father has not had a gun or pistol in his house for 10 years. Ester had not made much fence when he was forbid. Ester was fencing on the road when Cairns was coming in. No person stopped him.

*Re-examined by Kerr.*

Ester was stopping up the road and fencing all round. We would have been obliged to keep the water out of our shaft had we worked ;

and therefore no water would have run into Cairns' works. I don't think Duffys had 100 chaldrons raised, but they had more than 50.

*John Con.*

I know the parties. I am a Scotchman—a miner, working mostly in coal. 18 years ago, I landed in Pictou. I worked coal in Ayrshire, in Scotland. I have worked since I was 10 or 11 years of age. I worked 15 or 16 years in the Albion Mines. I was better than three years in the United States, working anthracite and bituminous coal. I have worked at the Albert and Hillsborough Mines. I went to the Hillsborough Mines last summer, and stopped till December, and then went into the plaintiff's employment. I have worked at the Joggins too. I know the Albert Mines took fire in September. I was then away. I had worked in them before the fire. The appearance after the fire was different. Some of the timbers scorched and burned, and some of the asphaltum melted, and run in the bottom of the level. Another man and I broke it up. I asked Brown what to do with the melted stuff—whether to send it up. He said yes, to be sure—it ought to be double price, it was refined. It had run 6, 7, or 8 feet, where melted. It looked dirty on the top, and at the heart it was quite clear. I was at the Pictou Mines when they took fire 3 or 4 times. I never saw coal melt and run. When cleaning out the Pictou Mines there was nothing but coke and ashes. This mine has not the appearance, nor does it carry the formation of a coal mine. The vein cuts the shale, and it has a great many small veins mining off—never saw the same in coal mines. Coal carries its floor and roof with it—parallel with vein. This mine has not that. This varies in thickness, but coal mines do not without coming on to a step or dyke. Mining is not the same in this mine, as in coal mines. Coal lies in a bed, and this is a solid mass, and is different from any coal mine I ever saw. I have melted it, and put it on my boots—melted it in oil and made a bright polish. I saw it melted in linseed oil, and hogs fat, and I have melted it alone. Some coal deposits have a fire clay floor, and some stone. We find fossil plants about coal beds. I have seen nothing but fossil fish about this mine. I never heard of fossil fishes about Pictou or Joggins' Mines. I never saw branch veins in coal mines. Coal lies in strata, and cannot be split perpendicularly, but horizontally, and this mine will break any way. I saw Mr. Robertson melt it in hogs lard and oil, and without anything, in a tea kettle on a fire, and after, poured it out; and it got hard and brittle when cold. Coal cannot be melted that way. I tried last Winter with Grand Lake coal and the

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Joggins coal, and the coal would not melt after boiling half a day in oil. I have seen some soft like India rubber about the place—not over half a mile from the mines. The vein I saw was not over a quarter of an inch thick. This mine smells different from coal—a strong nasty smell. The water from this mine has a lead smell, but I can't say much as to its difference from a coal mine.

*By Johnson.*

I worked perpendicular veins in the States, and the floor and roof were at the sides. There is something similar in this mine, but the shale is end on. I have seen some of the shale twisted, after being exposed to the sun—looked like horn. I never saw it overhang six feet in six in height. On the north west side of the vein, I saw fossil fishes. I found no fossil fishes in Pictou or Joggins. In the States the anthracite lies in beds, and breaks like other coal, but it is very hard. Cannel coal breaks all one way. The shale on the south side leans different ways. I can't say how the south side dips. You could not turn it so as to have a floor or roof, because the layers of shales come end on to the vein. I am employed now for Dr. Gesner, sinking a shaft not far from half a mile from Cairns' shaft. There are about 20 men and upwards engaged. We have got down 80 feet. We began in June. We have raised some black stuff. Robertson is boss, and Gesner superintends. We have taken up three chaldrons, more or less. We found the soft stuff there in the shale. The shale lies the same as the others. I will melt it outside. [Is shewn a specimen by Johnson.] I think this is anthracite coal. [Is shewn another.] I call this cannel coal, or parrot coal. Its cleavage is all one way—heat it and it will split. I have seen Egyptian asphaltum in Nova Scotia and here. I see no odds by that, except that it is softest. It has some smell when heated, and the same taste. I saw a jog in this mine last summer.

*Re-examined by Kerr.*

They might as well say shoemaker's wax is coal, as to say this is coal. This mine has no floor or roof. I think it has been hove up by the action of the earth between the shale. There is no pressure on it, as on a bed of coal. This shale is bituminous, and burns better than some sea coal. I never saw shale in coal formations burn. Henry Gesner hired me. I do not know Dr. Gesner in the hiring, and I do not know any connexion between Gesner and his son, and this matter. There are two or three small veins where we are now, and they intersect rocks in the same way as the other mines. The veins are very irregular; in some places thin, and in other places

thick. It has no formation of coal veins. I could not tell Egyptian asphaltum from this, when lying side by side, from their looks.

Court adjourned.

### THURSDAY MORNING, 22d.

*David Cullen.*

I reside in Shepody. I am a blacksmith. I worked here a year ago in May. I use Joggins coal, charcoal, and Grand Lake coal. Before I came, I worked with Pictou and Sydney coal. Six years ago, I worked on the Grand Lake 18 months, and after that in Nova Scotia on the North shore, three years. I have made a slight attempt to work with coal from the Albert Mines, in December last: it came from the mines in a sleigh, and was brought by Mr. Lyons; he works with me—he was out there on business, and bought a bushel more or less to try it. It resembled this very much in appearance—I tried it in the forge. I considered it did not answer as good a purpose as other coal. There was too much blaze, and a great deal of smoke, and it stuck to the iron and tongs in small particles. I can't say that was from its melting. I got no more. I found it did not answer. I used that bushel, more or less. I had plenty other coal of a poor quality. I tried it two different times. I did not try it more frequently, because I had no more of it. It is very convenient, if it would suit. Charcoal is used a great deal here. I did not examine whether it ran in the fire. I never knew other coal to stick to tongs or iron.

*Examined by Gray.*

I don't know cannel coal. I can't be positive whether it left any coke. I had doubts that it was good for my purpose. I pay sixpence a bushel for charcoal, and the Joggins coal I get for 5s. a ton at the place, and the freight paid. The Joggins coal would cost rather less than this, and answer my purpose better. They were a great many times yesterday in my shop, but I did not watch the operation through. I saw Chesley trying—he had some in a pot. I saw it when the pot was hot, and it was not then melted; they were blowing the bellows when I went out, and the pot was red hot.

*Re-examined.*

No one was present in the morning but Anderson and myself. I can't swear it is the same material as this.

*George Bowman.*

I know the parties and the Duffys. I have known Gesner since last Fall. I know the Albert Mines. I have been there off and on

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since they were opened. The Duffys worked them first about a year. I knew the mines after Milner and Gesner got them. I worked at the shaft for Gesner when Robertson was there. I went on the 10th January, 1851. I saw Binney there on the 9th—he put the party to work. I worked there a month. We opened a shaft about 12 or 15 rods from where Duffys slope was. Cairns sunk a shaft through to the slope. The shaft was nearer to us than the slope. It was not more than a rod I think from the slope to the shaft. We went on and raised about half a chaldron. Cairns came up and took possession by force. We did not go to war with them. We were too light for them. We then went to work shovelling and working about the pit. We worked no more at the asphaltum after they took possession and put a house over the pit. We were not doing much after, but keeping possession. After that we made no attempt to return into the pit. We worked, shovelling round, clearing away windfalls, and such like, and cutting firewood. Cairns and Brown came up on the 2<sup>d</sup>, and Cairns asked Robertson if he was keeping possession of the pit; if he thought he was, he would take steps to drive him further. They took away the asphaltum we raised. The plaintiff was not there during the time. The material we got out is like this (the bright piece.) I worked a month for Duffy, sinking the slope. I did not know what it was, I heard Peter Duffy call it asphaltum: he said they called it that in the States. [The Attorney General objects to the receiving of this evidence. Judge admits evidence of declarations of Duffy.] People would come, and call it coal. He said it is not coal—it is asphaltum. They called it asphaltum in the States. This was Peter Duffy. I can't say he said more at that time. I think John Duffy was in the States at one time. They hauled what they got to Edgitt's wharf, and it went to the States I expect. They had been working a year I think, when I heard Peter Duffy call it asphaltum. I heard tenpence a bushel asked—can't say whether by Cairns or Duffy. There were 10 to 20 teams, part of the time, hauling between the 9th January and the 4th February—20 or 30 chaldrons a day were hauled, may be more, and may be less. Cairns had likely got down 30 or 40 feet in the shaft, when I went there. I don't know whether they had taken any out, when I went. They were wheeling out shale, and were laying it on the ground. A great deal had been taken out and scattered about before I left—near an acre encumbered with shale, timber, &c. The land would be of no use till it was taken off; and until removed, the land would be useless, and it would require a great deal of labour to take it off. Cairns had 20 or 30 men engaged while I was there

taking up asphaltum and dirt. The teams had to come on the four acres to get the stuff.

*Examined by the Attorney General.*

When I went out, I found Robertson, his son, and Downie at work. We continued working there till the 21st, when we first commenced hauling up mineral—then defendant forbid us working. He came alone, looked at the mineral, and asked Robertson if they would go away peaceably. They said no, they would not. He forbid us taking away the mineral. He (Cairns) said if we did not go peaceably, he would drive us before him. We came up; and he shut up the shaft, and kept a guard on it. We remained on the ground. He did not tell us to go off the land, and I staid my month out. After that we were not molested in any way, and Robertson assisted in closing up the shaft. The shaft we sunk would have gone into the slope. When Duffys went out, Cairns went in. When I speak of an acre encumbered, I mean the land encumbered by Duffys and Cairns too. There was considerably more encumbered on the 4th February, than what Duffys encumbered. I can't say how much, but some—a considerable more. Duffys had encumbered about half an acre before Cairns came; and between the 9th January and the 4th February, I think half an acre more was covered with timber and shales. I can't say Cairns cut down a single tree on the ground after Duffys left. I think I could swear that there was over half an acre encumbered on the 4th February by shales of Duffys and Cairns'—will not say three-fourths of an acre. The shales and timber put there by Cairns, were within the space occupied by Duffys. The shale is spread in the vault, or hollow piece of ground. Duffys was in possession of the same ground where Robertson and Cairns sunk their pits.

*Re-examined by Kerr.*

I did not intend to say that Robertson assisted in closing up the shaft, but he forbid them touching any of his works. I saw no signs of our shaft going into Cairns'. Duffy formerly worked by a level in the bank, but he did not work there when I was there. The shaft we sunk for Gesner, we worked on the hill. I was in the shaft when we were driven out, and I saw nothing of interference with Cairns' works. I should say Cairns encumbered near half an acre beyond what Duffys encumbered: this was by shale—I do not mean wood. I saw Cairns' teams hauling wood too. The shale was levelled over the ground so as not to have any hills, and the teams passed over it: the levelling would cover more of the soil than if it was left in heaps. The level was 5 or 6, or 7 rods, from where the slope was. I don't think the

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shale from the two places was deposited in the same place. Cairns' shaft was about a rod from the other. It is likely the diggings from defendant's shaft and the shale were put in a different place. I don't know of my own knowledge of Duffys giving up possession to Cairns. I saw no other possession of Duffys than in taking out the stuff. I left the Duffys about the last of November, 1850.

*James Brewster, Esq.*

I am a Magistrate in this County. I have lived here 52 years. I have seen some specimens of the asphaltum. This looks like the mineral which comes from what is called Duffys quarry. I had some of it in the winter of 1850, when Duffy was working there—I got stuff from one of the Duffys. I went out to get it, and got it from the mines. There was not much raised—there were several chaldrons. I saw the level when they were working at it: it went in horizontally on the side of a slope. I went out partly to see it, and to get a little for fuel. I got over half a chaldron on a single sled. DeWolf went along with me, and got the same quantity. I took it to my own house, and used it for fuel in the grate. It acted pretty well, and gave a good light. The weather was very cold when it was burning. The grate was not large. I filled it full, and when it got properly heated it would run over the second bar, and sometimes the third, and would drop on to the hearth of the stove. After it dropped, it congealed, and formed a cone, and when taken up was extremely light, with scarcely any substance in it. We threw such into the fire, but I can't say it burned. The grate had four bars, besides the bottom bar. It generally ran over the bar next to the bottom bar. I can't say I saw it run over the third bar. Some of the neighbours saw it burning. I have put a small piece to the candle, to see if it would blaze. I saw Mr. Milner try some material—it looked like this: he took a piece larger than a bean, and put a piece of wire round it, and took a pair of scissors, and put it into the inner part of the blaze, and melted it. I saw him touch it with a knife, and then saw it drop. Mr. Upham and others saw it—that was during this month. I never tried it myself. Mr. Upham or his clerk went for the material, and brought it. I never heard of this material till lately. I never heard of asphaltum till this difficulty arose between Gesner and Cairns. I don't think it is over two years since I first heard of it at all. I saw coal at the Joggins, and from Lake Settlement. I don't think I have heard of coal being here, more than 4 or 5 years.

*Examined by Gray.*

My grate has transverse bars at the bottom. I can't say it ran



through the bottom. We put wood at the bottom. I never used old country coal. I have seen coal in forges swell and burst, but saw nothing run from it. If I knew other coal ran this way, I should think this was coal too. The highly bituminous coal is not the best for the forge. The cone that was formed had the color of ashes or sand, and was a different color. When put on the fire it was bright and glossy, and what ran down had no gloss on it, but was rough and had nearly no weight. I have a piece of what is called Trinidad asphaltum.

*Re-examined by Kerr.*

I can't say whether the change in color was made by the wood ashes, or by burning it with wood. The piece of asphaltum I have is not so bright a color as this.

*Jabez Upham.*

I reside in Harvey. I know the parties. I was present at my store when Milner tried the experiments with a piece of asphaltum. Milner said if he had some he would like to shew an experiment, and asked me if I had any; I told him I had. A year ago last winter several of us visited the mines. One person went down into the mines and got some specimens, and gave me this, which I kept at home. I sent a clerk for a piece, and Milner twisted a piece of wire round a piece, and held it over the candle; it broke, and then he held it in his fingers: it did not act entirely to his satisfaction. It broke and ran, and there appeared to be a crust on the outside, and a bitumen inside, which dropped on the counter. Particles that did not dissolve fell with the drops.

*Examined by Attorney General.*

Milner said it would melt. He said if it came from the outer part of the mine it would be less perfect than if from the inner part. He said it was not so good as he expected. I did not examine the drops after it fell till it got cold, and then it was hard, but had not the glossy appearance, but looked more like drops. My impression when it dropped was, that it was a fluid, but it did not spread or stick to the counter.

*Re-examined by Kerr.*

It did not drop like wax. I thought the hard parts dropped from the imperfection of the heat.

*John Foster.*

I know Cairns. I have worked at mines last winter and summer for Mr. Cairns. I work at the Joggins mines now. I worked in sinking

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new pit first. John Con was there working. The mines got fire. We left our lamp at face of coal when we went to breakfast, and when we came back it was on fire. We had left the lamp about eighteen inches from the coal. I think the gas took fire; this was last fall—fire lasted an hour and a half. We stopped up the pit and let the brook in, and extinguished it. The coal dropped down with heat—loose coal was left at the bottom, and that had burned as well as face, and when we went down there was a hard crust on top. I can't say they had melted. It had seemed to have run down from the face of the coal. We dug it up, and it went with the rest of the coal. I suppose about one and a half chaldron of it, not altogether melted—may be a chaldron of melted stuff that had run. When we broke it up it was not the same as the other; it was lighter, and more like a cinder. I put some in a box and sent it up. I took a pick and loosened it, and shovelled it up. Con assisted to take it up. I could not say it looked the same as the other. I never saw any coal run in that way. The inclination of Joggins coal is about one foot in three to southward. All rocks there dip the same way, and strata of coal the same range, and fire-clay at bottom about two feet thick; layer of coal about three feet nine inches; roof was free stone. I have seen trees and leaves—appearance of them in the stone above the coal. The Albert mines not the same formation as Joggins—not the same kind of rock, and don't run the same way. I saw fishes at the Albert mines, but no trees.

*Cross-examined by Gray.*

What was melted and ran down was something like coke. They tried to make coke of Joggins coal, and pit bursted; it got into a lump, but it was not coke—air got in. There was perhaps a half a chaldron of broken coal lying when mine took fire. I saw no remains of a stream that had run down from the sides—on the face of the coal it seemed as if it had run down: it looked as if it had melted on the face of the coal. When we struck it with a pick axe, it was softer than the other.

*Re-examined by Kerr.*

I never saw coke made. It was two or three days after the fire we removed the material. I can't say fire was from gas. Brown was there when we were taking out the stuff. The air course was put to let foul air out, and pure air in. Dan Robertson is working for Cairns now, and he was there when mine was on fire.

*John Goodall.*

I have seen material called asphaltum—[produces some]—this is some I got from Mr. Wainoch to-day. I can't say where it is from. After Court adjourned, Milner asked me if I would like to see some melted in a candle: he put a piece in a small tongs, and put it in a candle, until it dropped four times. I tried a bit myself. I put it in tongs and held it to a candle till it was melted, and it dropped from that three times. I held it over half a minute—it dropped blazing, and blazed after it fell. I then picked up the piece that fell, and it was like a cinder. I tried it before, and it would not drop.

*Examined.*

I had tried a piece before, but it did not drop: the piece I tried was not so thin. It was a small thin piece he had—it dropped on the candlestick, and did not stick to it, and remained in the same shape as when it fell. I did not try to melt it a second time—it would not melt again, it was like a cinder: wax could be melted over again. When I tried before, I had a larger piece, and it would not drop off. I can't say it broke off by its own weight; it was lighter after, than before.

*Richard C. Taylor.*

Deposition of, taken in Dorchester on part of plaintiff, before Amos E. Botsford, 6th June, 1851. (*Vide Deposition A. in Appendix.*)

*Doctor Robb, by Kerr.*

I am Professor of Geology and Chemistry at King's College, Fredericton. I have been so 12 or 14 years. I am from the North of Scotland. I have studied Geology, Chemistry, and Natural History, in addition to Medical studies. I have made Geological examinations before I came to this country—in Scotland, England, Ireland, France, Italy. I examined the vicinity of Glasgow, Edinburgh, and Stirling, in relation to mining, with a view to instruct myself and to give information to others who were interested in coal and iron. I have made explorations in this Province at Grand Lake; lead mines, St. John; copper, Bathurst. I have been twice at Grand Lake: first time about seven, second, about nine years ago. I went into all that were accessible. I also examined iron mines at Woodstock, twice in the course of the last ten years; also at Steadman's mines, at Memramcook. These examinations were made for my own information: whenever I had an opportunity, I have not neglected making researches to inform myself. I have been at a coal mine in Richibucto. I collected specimens, which are now at King's College, Fredericton. I have also extended my researches to Nova Scotia and Prince Edward's

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Island. I have been over a great part of Nova Scotia, Joggins, and Pictou Mines, and on the coast from Pugwash to Pictou, and the vicinity of Amherst, and at Windsor, and in Basin of Mines generally. They were working mines at Pictou and Joggins when I was there. It was in 1840, when in Prince Edward's Island, I searched to ascertain the nature of the rocks there. I have always when travelling, carried compass and hammer, and examined the Country through which I passed. I have done so in Canada and United States in a cursory way. I accompanied Professor Johnston over a great part of the Province, in 1849. I was asked to give information as to mineral resources, and I was engaged about six weeks in all. I was in most of the Counties, except Charlotte. I examined the rocks in this vicinity from Calhoun's down to Shepody, and up Muscle creek to its source. Near the site of present mines, I picked up or some person with me picked up something I thought a very interesting mineral, in a ploughed field near the head of Muscle creek, between that and water leading into it. I could not think it was coal. I took it to my lodgings—I was staying at Mr. Calhoun's. I saw an abandoned shaft there. I went for the purpose of looking at it. There was a very inflammable shale found in the river there. What I found was very black and lustrous, and light in weight—burned readily in a candle, and appeared to fuse. I did not take it to be coal. I suspected if it was not coal it was asphaltum. I had more than one specimen. I considered it of the nature of asphaltum, rather than of coal. I was satisfied then it was not coal from its mode of burning, and a comparison of its appearance with other minerals. It differed from coal in its resinous lustre, its lightness, and the peculiar brilliancy of its surface. I recollect I mentioned at the time, that it was not coal. I examined to ascertain its probable value and use, and interest, in a scientific point of view. I considered my opinion was confirmed by subsequent examination. I made a report on the subject. I examined the nature and position of rocks on Muscle creek to Frederick's brook—a small ridge between the two streams. I have been there since. The rocks on Muscle creek and Portage dip to the south, and on the northerly side of the Portage they have a northerly dip: the range is at right angles to the dip. The rocks on Muscle creek dips southerly till you get to Frederick's brook, when they dip northerly and westerly; this is the case for a considerable distance around. The general direction of rocks are east and west, or at right angles. A great variety of rocks, sand stone, shale, conglomerate. As to the shales, I saw not those I have been accustomed to see in coal beds. I looked for out-crop of coal there, without discovering it. The inclination in the mine is

very great—the rocks there stand from 70°, 80°, 90°, 65°, 45°, 50°. All these angles taken in the mine, and in the immediate vicinity of the mine. These rocks are supposed to have been originally horizontal, and thrown up by volcanic, or igneous force from heat in the interior of the earth, to the shape of a roof, making rocks dip nearly in opposite directions. I would consider the line of the force which acted on those rocks, had been somewhere in the vicinity of the mines. My opinion is that the rocks belong to a series which underlie the productive coal measures, and belong to a series called the unproductive coal measures. I did not see sufficient evidence to satisfy me that the rocks belonged to the old red sand stone. When fossils are abundant, there is no difficulty in ascertaining. All I saw there were fishes, except one small specimen: the fishes not such as I was acquainted with in old red sand stone. I thought if these rocks belonged to the true coal measure, I would have found abundance of vegetable fossils [looks at printed leaf and explains]. I was with Taylor and we examined mine; and

1. Found mineral almost vertical. Coal is found generally slightly inclined: this is one reason why we thought it a bed of ore, and not a bed of coal.

2. Instead of finding it of the same thickness throughout, as coal beds usually are, it ran from a foot to fourteen feet.

3. It ran in its general course. Instead of keeping the same point, it wavered and changed, and did not keep the same course, as coal beds generally do.

4. The principal planes of divisions ranged differently, being transverse instead of parallel.

5. Instead of the rocks lying parallel, they came sectionally upon the mineral, which is not the case in coal formations: in the majority of cases the ends come on instead of the planes.

6. The rocks of mine were colored brown with bitumen, and very inflammable, and we believed this color and inflammability were received from the same source as the mine itself, and a collateral proof of the nature of material of the mines. I never met with the same—brown paper, bituminous shales, with fossil fishes—in any coal mines. I never met with such shales in coal mines anywhere.

7. No proper roof or floor, or underbed of fire clay, as in coal. Here we cannot say it has any true roof or floor—the mineral and strata undulated. The floor of coal mines ninety nine cases out of one hundred has fire clay, and it has something like the roof of water lily: this was not present here at all, and instead of finding vegetable we found fishes. The fire clay is supposed to be the soil in which

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the plants grew that formed the coal. Every bed at Joggins has it, and at Cape Breton. Some of the most standard authors say, that a bed of coal invariably has fire clay: out of 136, there are three or four exceptions at Cape Breton. It is now looked upon as a general rule that under coal there is a bed of clay, and in that stigmaria, or the roots of plants that grew on that clay as a soil. We examined the rocks and sides of mines in every level we were in for fire clay, and found none. I have been three times to examine mines—to get facts to form my opinion. Cairns was there on two occasions. Dr. Jackson was there on the last occasion: our object was to get at proper grounds to form an opinion. The nature of roof of coal beds is very different—no necessary relation between them. The received opinion as to formation of coal is that it was at one time vegetation, and becomes decayed under covering of water or sediments of some kind, and so acquires a coaly nature instead of going off in gases as at the surface. [Describes how superincumbent strata of coal supposed to be formed.]

8. We found it gave off several lateral branches, which cut the rocks by which they were surmounted, which is not the case with coal mines. [Shews a specimen.] This piece shews veins running across the stone, and branches in various directions: this shews it is not formed between parallel layers as coal, but injected in liquid form, and has run into the cracks and fissures. I took this out of the mine, or from the shale at the mouth of the mine. I saw similar formations in the mine. I never saw such a thing in a coal mine, and I could not conceive of such a formation from coal; there were several branches running off from the main vein—one was nine inches. The report made by Taylor and myself, accompanied by a plan or maps. This is a copy of it. I assisted in making it. I gave my data to Professor Taylor. This is a correct illustration of the floor of the level, nine feet nine inches thick at north east end; space not colored is worked out at south west end—not a foot thick; the waved lines represent the walls; the figure No. 4 is a diagram, shewing veins and branches going off. I never saw such a thing in a coal formation.

9. The mineral occurs in bituminous marly shale, which at the mine is much disturbed and contorted, which is not usual in coal beds; and the same kind of rocks do not occur in coal formation.

Inferences—1. Mineral mass not parallel with surrounding measures, but cuts and intersects them.

2. That it is a true vein occupying a line of dislocation, &c., &c., and veins are conceived to be pushed upwards through previously existing rocks, and are not parallel to strata. What is called a vein of coal is not correct—it is a stratum or bed.

3. Its origin is posterior to bed of shale, wherein it occurs.

4. The position of vein more in accordance with occurrence of asphaltum. Professor Taylor describes asphaltum as a vein cutting through rocks.

5. Conclusion—It is asphaltum and not coal, or a variety of coal. Stratified rocks are found in the same way without coal. There are parallel seams in coal measures, but not in Albert mines. I know of asphaltum springs in the neighbourhood of Hillsborough mines—one is quite thin, the other thick—on north side of Joel Steves' brook, beyond Hillsborough church, over three miles from the mines. I believe the formation of the rocks on the other side to be the same as on this side, and the same series of rocks. The spring occurs near a small fall on Joel Steves' brook. It issues from a number of masses of lime stone and roots of trees. It wells up and covers the water; and thickens among rocks and roots, and some of it becomes of the consistence of India rubber, and part floats away: the thin liquid is naphtha, like oil or thinner; the thicker kind may be called petroleum, thick as tar. Such springs are conceived to issue from a subterranean source of a bituminous material. Its ultimate composition is very much the same as asphaltum. I found some specimens in May, 1851. Professor Taylor was at Ayres' farm. [Looks at soft piece produced by Robertson.] I have had specimens like this given to me: this is one of the stages between the liquid naphtha, and the hard asphaltum; this is one of the forms of bitumen—might call it mineral caoutchouc: it has the same constituents as the asphaltum; from exposure to atmosphere it would grow hard rather than soft. It could not have been hard when taken out of its bed. I have only tried the solubility of the soft kind. I found it dissolved in turpentine heated over a lamp, since I came here. Adjourned.

#### FRIDAY MORNING, 23d.

*Dr. Robb's examination resumed.*

I was acquainted with asphaltum before I saw Hillsborough mines. The resemblance—colour of asphaltum, jet black and opaque, same as Albert; lustre, like resin in both cases, highly lustrous, so as to reflect image; degree of hardness same; appearance of broken surface or fracture, large and conchoidal, which shews it to have been melted, or in a liquid state: this shews the same in a remarkable degree, and the conchoidal markings are seen on every face of it; the structure not laminated, or slated, or fibrous, or woody—Hillsborough the same. Its specific gravity 109; gravity of asphaltum, from 100 to 120. Its odour

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is bituminous, like asphaltum; it is a bad conductor of heat and electricity, so is asphaltum; it becomes electric by friction, negatively, and so does asphaltum; it appears devoid of mineral, charcoal, or black powder on the surface of common coal, so is asphaltum; clean to handle—free of brassy mineral, or sulphur, common to coal; it softens when heated, and melts—not so readily as other asphaltum; it yields a light, open and porous coke, like asphaltum. Asphaltum when wholly burnt, coke and all, leaves a very small portion of ashes—so does this, less than one per cent. Books state that asphaltum yields less than two per cent. When powdered, and boiled in sulphuric acid, it turns to coke, and that is given as characteristic of asphaltum; it becomes soft and flexible like India rubber at 600°, so does asphaltum; it dissolves in boiling oil, so does asphaltum; it dissolves partially in various other substances when powdered; it dissolves in coal tar. I saw Edgitt's boat covered with it. It dissolves partially in volatile oils—such as turpentine and oil of peppermint. This bottle of black liquid, produced by mixing powder with oil of peppermint, and leaving it in a pot of boiling water at 212°. Asphaltum will dissolve in same way, but more of it will dissolve. Asphaltum is accompanied by springs of naphtha or petroleum, so is this. It yields a highly illuminating gas, so does asphaltum. Asphaltum occurs in rocks of all ages—this in the lower, or unproductive rocks. Professor Taylor describes asphaltum of Cuba as running across from chink to chink of rocks, so does this: the cracks, when cooling, proceed at right angles to rocks. It has the same constituents—carbon, oxygen and hydrogen, and small trace of nitrogen, and small portion of earthy matter—asphaltum the same; substances are volatile, coke, and ash; proportions nearly the same with asphaltum.

ASPHALTUM—Volatile,	58½ p.
Coke,	40½
Ash,	1 p.

SYDNEY COAL gives—Volatile,	26.93
Coke,	67.57
Ash,	5.50

BARBADOES ASPHALTUM—Volatile,	61.60
Coke,	36.90
Ash,	1.50

No single variety of bituminous coal has the concurrence of characters this has. Common coal is harder, some much harder—fracture of coal conchoidal sometimes, and some places, but never conchoidal.



throughout. Coal always laminated, this not. Coal always presents appearance of woody structure through a microscope, this does not. Powder from coal is black, this is brown. Specific gravity 109, coal from 120 to 175. Coal no smell when rubbed, this has. I have not met with any coal which by rubbing becomes electrical, this does. Coal does not melt by heat, this does. I have tried to melt coal without success. I have an impression from a seal (this is it) made upon a piece of melted ore, melted in a spoon by heat alone, without any solvent. This could not be done with coal. I have broken pieces after melting, and the broken part presents the same lustre as before, and it will flame and melt again, and may be taken and dissolved in heated oil, thinned with turpentine and passed through a filter: this is a bottle of it. [Looks at specimens produced by Edgitt.] These might have been produced in way described by him. Coal does not inflame so easily as this. This can be fused in flame, or by heat. It behaves like amber. This is a piece. It is a fusible substance at 574°. I have often fused it at the same amount of heat as this. By holding amber over flame, it will be partially decomposed before it is fused: best way is to put it in the middle of a large flame to melt it. Coal yields an impure illuminating gas, which requires to be purified—this is much purer. Coal yields a hard and compact coke—this is light and powdery. Coal yields a considerable ash—this very little. Coal is insoluble—this is soluble. Coal occurs in upper coal measures—this in lower: there is no giving a good reason for this occurrence. Coals are in beds parallel to walls, and this is in a vein, and not a bed. Coal is underlaid by shale with stigmaria. At Sidney, 37 coal beds all underlaid with stigmaria; at Joggins 37 and 36 underlaid with clay and stigmaria. Coal is not usually accompanied by naphtha springs—this is. Coal walls are parallel to beds—here they are at right angles.

I call this a mineral: the ore of manganese is a metal; manganese is a mineral. Limestone is enumerated among minerals. Plaster is among minerals. All substances in nature considered vegetable, animal, and mineral. Mineral includes all substances not animal or vegetable. An intermediate class called fossils, which may be vegetable or animal. This substance I consider to be a mineral. Air, water, and ice, belong to the mineral kingdom. Common soil is chiefly of mineral substances. Subsoil consists of mineral substances. Plaster is a mineral, and is also called a rock. Potters' clay is produced by change of mineral substances. Pure sand is a powdered mineral. Paint is a mineral: it is found here, and clay too. There is plaster in the County of Albert in several places. I have seen mineral paint in this County.

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Slate, in some books is called a mineral, in some called rock : there is some in Albert, eight or ten miles below. A rock is considered a mixture of minerals. Limestone belongs to the mineral kingdom. Grindstone is a mixture of minerals. Freestone is a rock, and belongs to the mineral kingdom. Marble is a mineral. I have seen it in this County, at Hayward's Mill Stream. Metals are found, gold. Compounds called ore, such as iron. Many ores of iron injected into rocks from below. Gold in California is a mineral. The copper at Lake Superior is a mineral. Lead generally occurs as an ore. Silver frequently occurs with lead, and also with copper. Gold, silver, lead, and copper, if pure, are called metallic minerals. Diamonds are combustible mineral. Tin and ore of zinc are metals. This is not a metallic mineral. A mine is an artificial opening made by the hand of man for the purpose of extracting minerals. Before they are opened I should not use the word mine, as applied to them. In the works of science of the present day, word "mine" always used in reference to an artificial opening. I have heard of asphaltum of Peru requiring heat between five and six hundred degrees to melt it. If you melt a piece of sealing wax, it gives off gas and retains its character of wax. Taylor's work spoken of as best authority on the subject of coal.

*Cross-examined by Johnson.*

I am Professor of chemistry and natural history. Geology is a part of natural history. The strata are very much broken near the mines. I have been at Baiseley's farm, ten miles to the N. N. W. of mines. Dip there was north 45; at Demoiselle creek, south east from mines at Hayward's brook, dip south and south east 15 or 20. At my visit to mine I found the angle of dip vary from 50 to 85. The first rocks below it I think were 65 at the asphaltum rocks. At Baiseley's farm, dip 45; further up the mountain, 75 to 80. The shale in the mine appeared contorted and twisted in some places—at the horse the shale was bent almost at right angles, a sort of arch. The wedge shape was both horizontal and perpendicular: in its horizontal shape it was regular, and was said to increase downwards; the mineral broke off from the cheek of the mine. If the mine turned short to one side, and then proceeded parallel, I would still call it a vein; there is no rule as to direction of veins, but there is for beds. That is a diagram to explain our views. The vein is eight or nine feet wide where it turns off; and the continuing vein is only nine inches. [Is shewn a diagram.] I would call this a turn in the vein. Supposing it to be a coal bed with such a turn, I would call it a fault. This diagram is based on supposition. The uniform occurrence of fire

clay is established under coal). During the age of coal formations vegetation was more luxuriant. It has been supposed coal beds formed sometimes from drift material. Drift stuff might collect mud underneath, and would form shale; and mud would drift over, and form shale. After tide goes out here there are rents and cracks in every direction in the mud. Formation of coal is formed by great pressure. I never heard the term liquefaction applied to bituminous coal; if it is used, it is loosely used. Microscopists assert that they can discover cellular tissue in coal. When clay is suddenly dried it cracks. This book states, "the most perfect bituminous coal undergoes liquefaction." I have not seen a mixture of vegetable matter in asphaltum. Plants grow very near the margin of Pitch Lake in Trinidad, and parts may be enveloped in it. I see no difficulty in supposing bituminous substance to rise and impregnate the shale. I took the notion that the shales were impregnated with animal substances. The bitumen of vegetables would produce bituminous shales: more or less heat always attends decomposition. If coal formed in a basin, it would be deeper at the centre than the edges. I think the shale existed before the vein, and that the material was forced up through a fracture. The substances in my opinion is posterior to shale. The absence of stones or mud in coal is against the idea of drifting. I would consider it a remarkable thing in this instance, if fish were found on one side and plants on the other: the vent here occurs through several beds. The occurrence of fish and plants as mentioned would be a new case. I did not agree with Taylor as to its position. I considered it to be of great importance in testing this as coal, to ascertain whether above or below old red sand stone, because workable beds of coal are not found so low as below old red sand stone. I believe thin layers of coal have been found in old red sand stone. The highest mountain here is lower geologically than the lowest. There is in Virginia a coal bed on granite, with a layer of clay under it. I have seen shale taken from mines near Glasgow by miners, and used as coal. It was not like this—it was black. I dare say there was enough inflammable matter in it to use for engine. I know that Dr. Gesner reported a nine foot vein. There are a great number of seams of shale there, and I would not call it coal. When I visited the spot, I could not find the nine foot vein of coal, and I inferred it was the bed of shale which he had called coal. If a bed of coal being horizontal, was as much raised as this, it might be crushed, and would be much less bituminous, and become anthracite. The theory of anthracite mines is, that they were formerly bituminous and horizontal, and that during their elevation there was a pro-

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cess of distillation which deprived them of their bitumen. In such a case when made vertical, the roof and floor would become sides—the distillation would be produced by heat. The anthracite coal of Pennsylvania has clay and fossils. If this mine elevated without distillation, it would be inexplicable; the rule is, the more highly a bed is elevated, the less bitumen it contains. If a bed were entirely enclosed, the distillation might not take place. It is possible that there may be elevation without distillation. I have seen bituminous beds inclining  $24^{\circ}$ . My opinion is, that the force in this case was in a north east and south west direction, along the line of the mountain. It struck me the force was from beneath. I have known other coal that had the conchoidal fracture, but not so equally as this. I saw nothing akin to lamination in any part of the mines that I saw. I never knew any coal where the lamination of the mass was so utterly destroyed as here. I was never in a bitumen coal mine upheaved as this before, or in any anthracite mine. I have been in a great many bituminous coal mines. Joggins and Pictou are highly bituminous. The only bitumen coal I have heard of is Burmese coal, which contains as much or more bituminous matter than this. Taylor refers to it. The analysis is nearly that of asphaltum. I have seen the Boghead coal; it is highly bituminous; quantity of volatile matter is about the same as this. The Boghead coal splits better in one direction than in another. It is a brown substance; it was discovered last year. It is not the least like this in the fracture: in one sense it has a conchoidal fracture. It is not a week since I split it in various ways. I would take the first six pieces of house coal, and fracture alike. I would think this to be a piece of cannel coal: this looks like a cannel coal, and is distinctly laminated. I would not say that this would produce ten per cent. more volatile matter than Albert mines. [Two specimens marked W.] The specific gravity of anthracite higher than others; possibly there are other coals which contain as small a portion of earthy matter as this. My opinion is formed from a concurrence of circumstances. There are asphaltums which have more ash, but I can't say coals which have less. Most coals have in part a conchoidal fracture. I did not see the rock on which the shale rests. Rocks may be bent after they are hardened, but more likely to be so when they are softened. The cheek that overhung at one time, was under at another; the southerly side in one place overhangs. In the level called No. 7, it overhung sometimes on the right hand, sometimes on the left; the mineral had the same general formation, north east and south west direction, as the surrounding strata. I believe some coal seams vary considerably in

their thickness ; those I have seen do not vary. I first visited the mines the 21st May, 1851. Cairns, Brown, and Barber, accompanied me. I went again on 24th with Taylor, A. E. Botsford, and the gentlemen formerly named ; again on the 27th, with Taylor, Jackson, Foulis, and Brown. I about that time examined a pile of material near the wharf—a large heap there. I have not the slightest recollection of saying that the substance there had every appearance of being coal. I might have said it jokingly, but not seriously. I might have said it ironically. I consider it a mineral. There is a general division of mineral substances. Plaster is both mineral and a rock : when seen through a microscope it is much the same as asphaltum. Asphaltum powder is brown, and powder of this is black, and in very small powder is brown. Smell is same as asphaltum, though not as strong. I can't say the taste of asphaltum is the same, for I do not recollect. I say this has more the nature of asphaltum than of coal. I have not seen any asphaltum like, or coal like it ; my opinion, it is more the nature of asphaltum than of coal. I believe it is a variety of asphaltum, and not of coal. I consider it referable to asphaltum, and not to coal. I have not met with any coal which behaves itself like this, and therefore I cannot call it coal. I have not seen half the varieties of coal probably, or of asphaltum. Coal is divided into cannel, bituminous, and anthracite, and there are varieties in each. Coal is much more variable in its character than many other minerals. The conchoidal fracture is evidence of evenness of structure, and that may be the result of heat. Flint has a conchoidal fracture, and it does not follow it was ever in a liquid state. It is in a general way assumed that the conchoidal fracture is evidence of partial softening. I mean to say lamination cannot be found in this mine as in slate : there may be coal of less specific gravity than asphaltum. If this mineral had charcoal in it in the same proportions, or nearly so, it would have a strong bearing on this case. I looked for pyrites and sulphur, and found none. It occurs in many rocks, but it is a weak point. I have never seen any species of coal that would melt as this. I have found nitrogen in this mineral, but not in asphaltum—others have found it in asphaltum. Coke from asphaltum is light and powdery. There may be coal which produces coke too light and fusible for mechanical purposes. It is a well known difficulty to know where bituminous coal ceases and other begins. It has not been asserted by me that bitumen exists in coal ; I cannot prove that it does. All other asphaltum would liquify at 600. Every other kind of asphaltum, except this, melts at 250. I have tried this under a red heat in dark about 900°. I pierced a hole through it. I am not prepared to say I melted

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it at 600, and then it was only pliable like india rubber. I could dip asphaltum into boiling water, and take it out immediately and make an impression on it. I heated this piece, sealed to about 700. Sealing wax is composed of shell lac and coloring matter. We do not speak of the coloring matter as fusible. Sand would mix the same way with coal tar, when boiled in turpentine—the bituminous matter in it mixed with the turpentine, and I observed that the residuum would be about ten or fifteen per cent.; it was in fine powder. I have boiled the same oils down to dryness, without any blackness. Almond oil boiled down in an open vessel is not discoloured: had the powder been pure asphaltum, there would not have been so much residuum: with oil there would not have been more than five per cent. less. Many asphaltums would have dissolved altogether under the treatment I gave it. The spring I found is four miles from the mine. A pretoleum spring might exist as this, and yet it might be a coal mine. I have heard of pretoleum springs within half a mile of coal mines. As to gas, the less the carbon the purer the gas. I never heard of any coal which comes near to it in purity, except Boghead cannel. I saw gas from it burning in Dartmouth, Halifax, and in a steamboat in St. John: the gas was brighter than other gas. This article produces better gas than common coal. This article possesses a great many properties in common with coal, and not with asphaltum. It possesses properties in common to both. I consider its fusibility and solubility separates it from coal. I think asphaltum would not do for welding iron. I can't say it could be done with this. According to ordinary forge work, iron could not be welded with asphaltum. In the east (many places) asphaltum is common fuel, and used for japanning and for cement. Asphaltum may be used in gas making, and so may coal. I would not like to burn asphaltum in my stove. It is used as fuel round the Caspian sea. It has been used mixed with sand and gravel for pavement. I saw no fossils characteristic of coal measures. I might have said the discovery of fishes was of no moment, unless they discovered plants. I may have said the absence of fossil plants shewed it was not coal. I saw several fossil fishes—I was not acquainted with them: they are characteristic of coal measures, and the series above: from the coal measures to the oolite they occur. I have made this liquid in a spoon, so it could be poured out of a vessel. It was a platinum spoon I used: it will stand a great amount of heat: it was under a red heat of 7 or 800—I held it a couple of minutes. A much less degree of heat would have done with any other asphaltum, probably 250°.

*Re-examined by Kerr.*

There are bituminous shales entirely unconnected with coal. The rule is that seams of coal are uniform, but there are exceptions. From the analysis of Burmese coal, I should call it asphaltum. Boghead coal is very light outside, very tough and tenacious; and when broken it appears more like brown bituminous shale, than true coal. In the Gas Light Journal, it is called the Boghead cannel. According to the upheaving of the rocks, the mines could not run in any other direction. There is not so great a difference between this and other asphaltum, as between different kinds of coal.

*Samuel Gross.*

I was requested to go into the woods yesterday, to Peck's creek, between one and a quarter and one and a half miles. Reuben Calhoun, Abner Jones, and John Robertson, were with me. We saw Dan Robertson and another man there. They show a substance, of which these are specimens. Robertson and his men broke the rocks, and we picked them up. About fifty rods further up, we found a harder kind than this: these are the harder specimens.

*Examined by Gray.*

We were to go out and dig specimens, or see them dug, and bring them here, such as Robertson should point out. I am a blacksmith. I have used stuff from the mines in my forge. I hauled it from the mines. I undertook to use it, but I could not work it; it made such a desperate blaze, and ran together so, I could not use it. I welded iron with it, mixed with charcoal. I am brother-in-law to Dawson Steves. Before Dawson Steves made his lease to Milner, I knew from report that Duffy had sold his lease to Cairns. I might have told Milner that I heard so, but I don't recollect. Milner used to stop at my place, and from that I might have told Milner, Duffy had sold to Cairns. I stated to Mr. Cairns that I was disappointed in not getting an interest in the mines. I put a fire on in my stove, before Mr. Jackson, Cook, and Anthony, and burnt the material. I have mixed it with wood. If you keep a hole in the top to let it have vent, then it will go. From where Cairns works, it is N. N. W. to where we got the materials: I should think about half a mile below Bowman's mill.

*Reuben Calhoun.*

I went with Gross. These specimens were brought from Peck's creek: we saw them severed by Robertson with a pick. A crevice in the rock could be no deception.

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*Doctor Charles Wetherell.*

I am a native of Philadelphia. I am 27—will be 28. I am Analytical Chemist and Lecturer on Chemistry at Franklin Institute—have lectured there three years : educated partly in United States, partly in France, partly in Germany. I attended Lectures under Professor Fraser. I went to Paris and studied under several—Pelouse, one of the first Chemists. The following winter I passed in Germany, under Leibig—there about eight months. I published several articles when there. I got the degree of Doctor in Philosophy in Germany. In spring of 1851, Mr. Legal handed me a specimen for examination—this is a piece of it. I made an organic analysis of it. I am not aware of any other person having made such an analysis. I made a comparative analysis of Cuba asphaltum of same nature. I afterwards made application to Professor Cressin of Philadelphia Gas Works, for some more. This part of it obtained from Gas Works—a large heap, and this large piece from same heap. I got that to see if it was the same as I got from Mr. Legal. I applied to him for the Hillsborough asphaltum : his son shewed me the mass, and I selected the specimens ; they had the same behaviour with the piece obtained from Legal. I tried the action of several re-agents. The specimen given me by the Court last night is similar to the one I tried in Philadelphia. [*Attorney General* objects, that it must be first shewn that the specimen came from Albert mines. *Mr. Kerr*—We need not shew it came from Hillsborough mines : we don't care where it comes from. Judge asks *Mr. Kerr* whether he will identify it as a piece from Albert mines. He says he claims to prove experiments on a piece of mineral called asphaltum. *Mr. Milner*—We want to shew that there is a variety of asphaltum sold in Philadelphia, and we wish to shew its properties as asphaltum. Judge decides that the evidence may be given to shew an analysis of a mineral obtained in Philadelphia, and that it must receive its value by relation to subsequent evidence of analytic comparison or identification.] I obtained mineral in Philadelphia. I have a memorandum in a book. [*Attorney General* objects, that he cannot be allowed to look at the book.] I have my laboratory book at home : I do not allow it out of my safe. I have compared this with my book, and find it substantially correct, and I corrected the typographical errors. [*Attorney General* objects, that he cannot refer to this to refresh his memory. *Johnson* says, can't refer to a copy of a copy, nor to a copy if the original in existence. A mistake in a figure would make all the difference. Judge allows him to refer to book.]



*Cross-examined by Attorney General.*

The proof was not sent to me to be corrected. It is a copy of a letter given by me to Professor Taylor. I gave no directions to have it printed. A copy of my letter is in my book. I am prepared to say it is an essential copy, as to all the calculations. I have never seen the letter since, or compared this with the original letter sent to Mr. Taylor.

*Re-examined.*

The original is in my book, and I am satisfied this is correct by an examination and comparison. I was more particular about the calculations than any other part. My letter was a copy of my book.

*Questioned by Gray.*

I could not have made corrections without referring to my original memoranda. I could only then test its correctness by reference to my memoranda, and not to my memory. I think I furnished a corrected copy to Legal—as corrected, it is a copy. I would not like to swear absolutely that it is a verbatim copy. I could not tell without reference to this book the particulars of the analysis. [Gray objects to his refreshing his memory by reference to this book. Same as letter in letter book—party could not give copy; the memoranda book of witness is the only one that can be referred to. Palmer—The copy should be made when the subject matter is fresh in his memory. Kerr in answer—Witness entitled to refer. Gray in reply. Judge decides he cannot refer to the book and show the analysis.]

*Direct examination proceeds.*

I made one analysis from asphaltum of Cuba, and one of another piece. I examined the density—it was not high. This is a paper read by me before the American Philosophical Society, in June 1852, which contains the data of my analysis. I found the two specimens bore a great analogy to each other; I allude to the one I got of Mr. Legal. Comparing as to color—the powder of the other specimen was darker than the Cuban: both under the microscope transmitted brown light in their fragments. I have not a specimen of the Cuban asphaltum—the lustre was very bright and resinous—the fracture conchoidal, and very similar in both cases; the odour of the other was highly bituminous—the hardness very similar to Cuban asphaltum. The experiments of melting were tried this spring—this is a part. I placed some of the asphaltum in small fragments in a flask, and applied gradual heat: at first a white vapour came over which burnt brilliantly, and was not condensed by cold water applied to the tube.

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On looking into the flask, I noticed that the fragments, which at first were piled up, had settled down to level surface. I detached the tube, and shaking the flask found the substance liquid, very similar to molasses: I poured it out into a piece of broken flask and allowed it to harden, and this is it. It was a portion of this piece that I dissolved—obtained from Philadelphia gas works. Adjourned.

### SATURDAY, 24th, 9 o'clock.

#### *Dr. Wetherell's examination continued.*

I repeated the experiment in the same manner, and instead of pouring it out, I turned the flask on its side; I allowed it to cool and solidify in flask: this is it. I did not consider the degree of heat essential, and therefore I did not ascertain it—I only wished to discover whether it was fusible. I immersed a piece of same material in heated coal tar pitch, and it became soft, and could be moulded into any shape; and when cooled and broken, presented a bright appearance, approaching the original substance. The piece melted in flask, when broken, presented nearly its original brilliancy. I made a set of comparative experiments as to solubility of this article, as compared with Cuban asphaltum and cannel coal: I took similar portions of each of their kinds, and tried them in chloroform, lard oil, linseed oil, and turpentine. I tried to see how they would behave under the same circumstances; and in the same time they were all powdered. The result to my mind was that the substance was asphaltum and not coal, because the reactions of solubility were more allied to Cuba asphaltum than to cannel coal. The cannel coal was not taken up by the same solvents or menstrua, but the others were. I also tried experiments in order to dissolve it alone: one was to place turpentine in a flask with a tube inserted in the cork, and connecting it with another tube containing fragments of the article—another tube cooled by water: the turpentine boiled, and vapours passed to the article and took up certain portions. The vapours being condensed passed back over the particles, and the result was that a certain portion was taken up in solution. I have not any of the products of experiments. I did not weigh to determine amount taken up. I evaporated some of the turpentine, to assure myself if some of the asphaltum remained. Another experiment was to powder and mix it with turpentine in a vessel—applied heat: can't tell the amount of heat. I found that apparently more taken up. I have none of the article so dissolved. Third experiment—I powdered it very fine, and examined it under a microscope. I found very minute particles were transparent, transmitting brown light—were coarser fragments, which at edges also were thin

enough to transmit brown light. I placed it in spirits of turpentine, applied heat, and filtered it, and obtained this varnish [in bottle]. On examining the residue with microscope, I noticed the smaller particles transparent, had diminished; the residue was not dissolved, and was taken and treated with oil of peppermint; heat applied, and filtered; and this is the liquid [the bottles marked]. I examined the residue by microscope, and the fine particles had continued to disappear. To this residue, pure oil of peppermint was added, coal tar, naphtha; and found a greater quantity taken up, and I placed the solution together with the residue in this bottle. I examined this also under the microscope, and found the smaller particles acted on and dissolved, and larger particles still presented brilliant appearance at edges, as at first. Not dead black appearance of coal. The inference I drew was, that it was asphaltum, not coal; and that I could dissolve whole in either of the menstrua. The residue was not coke or carbon, but was the original article, not altered in its original character. The finest particles obtained are by scraping of a sharp knife; these were put in a watch glass with turpentine, heat applied, and then put under a microscope; the fragments appeared transparent with a brown light, and they were observed to gradually dissolve and disappear, leaving a thin cloudy substance, which I took to be the ash. If particles of sufficient fineness, would all dissolve. The fragments of the original mineral were homogeneous amorphous, and of nature of glass as to transmitting light, and no specks on it. Those experiments gave me the color brown. This glass contains the powder, and the smaller particles adhere to the glass, and are brown. The particles must be thin enough to transmit light to shew the brown color. I rubbed Cuban and Egyptian asphaltum on my coat and silk handkerchief, and attracted bits of paper: the other specimens are the same; all highly electrical [an experiment tried]; these bits of paper attracted by it. I tried similar experiments with cannel coal, and could not obtain same effects. I have never met with an electrical variety of coal; coal is used in a certain form in galvanic batteries, which could not be if electric. I made an experiment with a piece obtained from Court. Strongly electric by friction. This is it. Another specimen, given to me by Dr. Leidy, I found electric. This is it marked. This piece given to me by Dr. Antisell. I experimented on this to find its electricity, same as others, and I examined all under a microscope. I experimented on a piece melted and ground out, and found it also electric by friction. Under microscope the thin scrapings were transparent with a brown light. I have not tried coals with this. The coals I have seen tried were opaque, and do not transmit light.

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I experimented yesterday. I held fragments in lamp, and they behaved like piece received from gas works, and Legal; and putting small fragments of all specimens, and placing them in a platinum spoon, in flame of lamp, they fused, and I poured them out, and got impressions of seals, which I brought with me. Upon breaking the pieces is seen that brilliant appearance—the same, and conchoidal fracture. I tried experiment of fusion on piece Court gave me, in flame of candle—then let it harden, and scrapings of this could not be distinguished from original. Inference drawn is, that residuo is not coke, but the original substance. I remember result of organic analysis. On comparing two analyses of Cuban asphaltum and Legal piece, I found great resemblance. The inference I drew was, that the substance was asphaltum, and not coal. The piece I got from gas works agreed with piece I got from Legal, so that no chemist would say they differed. I am satisfied the two substances were identical in character, and agreed perfectly with specimens given me by Doctors Leidy and Antisell. I have no doubt as to the identity of their character, and I believe them all to be asphaltum, and not coal. The article is dissolved in the two first bottles, and not merely held in solution. The Cuban and Egyptian asphaltum behaved very similar as regards their solubility and fusibility, but Cuban and Egyptian more easily dissolved; but in my opinion amount of heat makes no difference; the only question being whether soluble and fusible. In some instances the degree of heat necessary to melt would determine the character of a substance, but not in this instance. All of such specimens, fusible or soluble to a certain extent, I would call asphaltum. There is an analysis of asphaltum from South America, by Dr. Boussang, which by his description presents the same appearance; brilliant conchoidal fracture; density corresponds with, in small quantity. He states it is soluble with difficulty; and his analysis corresponds nearly with mine. I would judge it very similar to this. I would not be able to say whether these specimens did not come from same place. There is another analysis of asphaltum from Beeklebawn, corresponding nearly with this in its carbon. I never heard of a coal like these specimens, nor saw any description like it. I could get nothing in any books like it, called coal. I have no doubt all these specimens are asphaltum, and not coal. I saw a collection of coal in Franklin Institute, and in Academy of Natural Sciences, and I did not see any coal looking like this. I have seen asphaltum approach this, but never saw any asphaltum exactly like it.

*Examined by Attorney General.*

To be a chemist you must work yourself. I have worked in my

own laboratory about four years. I have never visited an asphaltum mine. I visited coal mines in Philadelphia. Oak line colliery—anthracite coal. I visited other mines, but can't recollect. Before I went home to study, I examined a bituminous coal from England—the cannel. There may be some new coal discovered having a transparent appearance, but I have never seen any. This specimen differs from Cuban asphaltum. I do not think it differs to a considerable extent from it; it contains the same elements—carbon, oxygen, hydrogen, and nitrogen, and a very small trace of sulphur, and inorganic matter. Coal always has more sulphur. The Cuban asphaltum contains the same elements. The difference is, this is more brilliant lustre, Cuban has more brown powder. The amount of heat required depends on combination of ingredients. A greater amount of heat is required for gas work coal than Cuban asphaltum. It would take more heat to fuse glass than asphaltum. I have not tried this experiment on Cuban asphaltum. A portion of this charred at the bottom, formed a non-conductor. I put some of Cuban asphaltum and some of this in boiling water: Cuban became quite soft, this a little, but not so much. I should think Cuban asphaltum could not be used in forge for blacksmith work; I don't believe this could be used for blacksmiths' work, because so like asphaltum. If it should appear that it was so used, it would not alter my opinion. I never saw any asphaltum exactly like this. As far as the external character of this goes, it is new to me. I found it adhere to paper. Bituminous coal, so called, does not contain bitumen. I would not like to say coal was fusible in proportion to the amount of its bituminous matter: I tried fragments of bituminous coal held in flame of candle—held a piece in flame of candle. In making up my opinion, I did not take degree of heat as a criterion for forming my judgment. I am prepared to say that the cannel coal would not fuse at the same temperature. I know Dr. Hayes, a very scientific man; Professor Silliman I know Dr. Torry, very high reputation; Dr. Teschmaker, high reputation too; Dr. Elliott, high in reputation; Dr. Jackson, don't stand high with us. I was applied to by Mr. Legal of New York to make experiments. I came on here at the instance of a brother of his. I don't think asphaltum could melt without losing something [looking at first bottle]. I can't say asphaltum would have wholly dissolved. I don't believe there would have been any residuum from Cuban asphaltum, except inorganic matter. I think the Cuban asphaltum powdered is brown. A chemist would call this a brown powder, [breaks the bottle with it in.] This is coke charred at bottom. I can't say Cuban asphaltum would char. I can't say oxygen is most important part in coal—I think not.

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*Re-examined by Milner.*

To remove colouring matter of asphaltum, would be to dissolve it. Coals are called bituminous, because by heat the gases form a new compound, called bitumen. The general appearance is in favor of its being asphaltum. I know it is used in Philadelphia instead of resin in making gas. I would not say that Cuban asphaltum is the standard of asphaltum. Dr. Jackson has not the reputation in Philadelphia of an accurate experimenter. If resin melted, and bubbles of gas escape, it does not change its property. There is a greater analogy between this and Cuban asphaltum, than between anthracite and bitumen coal.

*Doctor Antisell.*

I reside in New York. I am an analytical chemist; teacher of chemistry, and lecturer on geology. I am engaged as a chemist since 1843. I was educated as a medical man. I belong to Medical College in Woodstock, Vermont, as Professor of chemistry. I have been concerned in geology since 1846-7. I have examined various districts in Ireland: Coal District, Wicklow, and the Coal Mines; three of anthracite and two of bituminous coal. I examined them for my own information. Three of them in operation. My examinations made in 1848. I have examined no coal districts in America. The principal branch was analytical chemistry. The only examinations I made of asphaltum was last year, at the request of Mr. Legal in New York. I examined three varieties: Cuban, Trinidad, and Hillsborough. This is a piece I took out of Hillsborough mine yesterday morning. Dr. Leidy accompanied me; Dr. Hayes and Mr. Drek, descended with us. We went down about nine o'clock, A. M. I examined particularly. We were there one and a half or two hours—we descended shaft 150 feet deep; found ourselves at the entrance of gallery, said to run 300 or 400 feet. We examined the lowest level first, at the west end; the vein runs north east and south west; mined to extent of 350 to 400 feet; average breadth, nine to ten feet; shales on both sides bent and curved; in lowest level shales dip at angle of 75°, left hand side; opposite side was nearly vertical; we ascended a few steps and entered eastern gallery, another level; wall on the right side is composed of shale and iron stone, dip west 60°, edges of shale to vein. Opposite side, called floor, dip 55°; no fire clay, no plants, no roof on right side; farther on, same level,

rocks, yellow shale, dipped 70; in centre a horse—two pieces of rock with mineral between. We passed up into level two; on left hand side, shale, edges to seam, and mineral fits into edges of seam; we came then to the end of the work in that level. The seam thins off. Course N. N. E. We passed the level No. 1, right hand side, dip 75 west; further on, floor is parallel with roof; greatest slope, 40 on either side; rocks here have sides to vein; from this point, thins off to three and a half feet, 120 feet from shaft; walls yellow clay shales; where veins were widest material was more solid. Contortions evident everywhere in shale near the shaft; contortions are found in different ways in a few feet; in several places gas escaping, which burnt with blue flame. The mineral was not conformable to surrounding shale. The dip varies from 40 to 80. Anticlinal axis has a fixed point. The strata dipped in two instances to form an anticlinal axis; in other cases they so dipped as to form an opinion that an anticlinal axis is there. I never knew coal found in an anticlinal axis. I looked for clay and stigmaria—found none. A soft yellow shale, which in some parts touched the mineral, and crumbled under the fingers, but no appearance of roots. In coal beds, in majority of instances, fire clay is between coal and rock; a few inches or feet of clay containing roots or stumps of trees and plants; and above, on roof, shale is unpressed with marks of land vegetation. These are characteristics of coal measures. This in its geological formation represents a vein formed by intrusion, wider below than above, vertical—thus off at each end. In no instance are the strata parallel to it as in sedimentary beds. Lines of division are at angles with strata; it rests on strata, and runs in small seams to rocks on each side. Some of the rocks are placed with the sides against the vein. Coal generally lies of regular width between rocks; but this varies, and the lines of coal are transverse to walls which are nearly vertical; the absence of fire-clay, floor, and plants above verticality of bed; thickening downwards with mineral diffused into rocks—sufficient evidence of injection or intrusion of mineral vein, and not coal. Its position has all the character of a vein of asphaltum, which is an injected body from below. I have seen remains of fish, fossil fish in the shale—in most instances scales, and sometimes perfect fish. Shales contain abundant remains of the palioniscus species. The presence of these does not indicate a coal field; it is found in strata without coal; it is not an evidence of coal; it exists in rocks of later formation than coal. I have seen the species in old red sand stone. Lyell says he has seen them there, and Hall of New York, says it is found in the silurian formation, below where coals are ever found. Lyell is president of the

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Geological Society in London... Hall is a man of first authority in this country. Wherever coal is found we may expect to find palæoniscus; but it may be found without coal. This fish existed before coal formation and after, so that its presence is no proof of coal. Coal is limited to beds of rock which lie on old red sand stone. Their seams are found below the old red sand stone, but never workable. A bed of coal is in almost every instance conformable to the surrounding strata. If bed is contorted, strata conforms. If I found a dark colored mineral in an anticlinal axis, and not parallel to strata, and below the usual situation of coal, I would call it an asphaltum. This vein lies below the usual situation of coal. In case of a break or fault in a coal bed, the connexion would be entirely broken off, and the edges of the coal would be thinned off. If it were injected from beneath, it would be in the position in which I found it. The whole disposition of the country about the mines bears evidence of upheaval and force from below. The shale bears marks of upheaving, and of rupture and fracture, and twisting, and the material has been injected, and has run into the different crevices. The position of rocks and other circumstances are inconsistent with a coal bed. I cannot conceive a coal bed to exist under such circumstances; for where bituminous coal is upheaved, it is always converted into anthracite. Bituminous coal is produced by decay of vegetation under ground; so long as unaltered by heat it will be bituminous coal; but when subterraneous heat acts upon it, it leaves coke, which is called anthracite; which contains no bitumen. I believe Professor Taylor stood high as an authority on coals. I brought samples of the coal and of the shale. I would term it asphaltum. I gave this to Dr. Wetherell; this is the piece I got at the mines. I took this from the vein; I brought other specimens. There are portions of the shales which contain portions of the minerals, not running through the layers of the shales, but passing through fractures in every direction. In ordinary coal fields, lamination of coal is in the same direction of rocks; but in this instance the cracks are transverse, caused by cooling downwards. I think anthracite coal is as brilliant as this. I have seen no tracks of vegetable structure. I have examined specimens given me by Legal, under a microscope, and saw no traces of vegetable matter: it bears all marks of having been fused at one time; it has the conchoidal fracture of asphaltum. Some coals (cannel) have conchoidal fracture. I examined the mineral which Legal handed in—it is identical in all respects to this. I made an analysis to determine volatile matter, coke and ash. The quantity of volatile matter is greater than in majority of coal, ash less, and coke small quantity; and bears no



relation to the original form of mass experimented on. In coal, coke bears the form of the original mass. It is difficult to melt, but can be melted in a spirit lamp. I have melted it. It requires a high temperature. I am satisfied it is asphaltum from three causes : 1. Its electrical property ; 2. Its fusibility and solubility ; 3. The absence of vegetable structure. These are the three features which make it an asphaltum. It differs from coal in its density and gravity. It does not soil fingers, coal does. Coals do not dissolve or melt, and I have never seen coal electrical. I have examined Cuban and Trinidad asphaltum ; they contain the three properties I have mentioned ; and contains no other property this has not, but differ in degrees of heat ; but it is of no consequence what degree of heat is required to melt it— if it melts at all, it is an asphaltum. An asphaltum is compounded of two substances, petroleum and asphalten. Trinidad melts at lower temperature than this, but at higher than Egyptian or Cuban. Trinidad and Cuban are perfectly fusible ; both dissolve in turpentine and naphtha. I have treated those with alcohol, ether, turpentine, and naphtha. 33 per cent. dissolved in ether ; about 50 per cent. in turpentine ; and seven or eight per cent. in alcohol. I have found great difference in coal. The difference between these asphaltums is not so great as between coals, and they still rank under the head of coals. There are great differences in asphaltum, we know of. The first I find examined happened to be a very dense one—greater than the majority of coals, and yet it ranks with asphaltum. This has less ash than Cuban, and less electricity. Less ash is evidence in favour of its being asphaltum. It is classed as a mineral. A mineral is that which is generally found included in rocks. Plaster, limestone, marble, are minerals, but sandstone and grindstone pass into rocks, though they belong to the mineral kingdom. Slate and hone stones class under term rocks, but belong to the mineral kingdom. Mineral paint, sand for glass, fire clay, manganese, ore, are minerals. Rocks are composed of minerals. I saw a great many stones about mines. They belong to the mineral kingdom. We don't usually call them minerals. Ice is a mineral, and water. There are minerals combustible and earthy, or metallic and gaseous. In some instances metallic formations are thrown up from below, and are sometimes produced from rock by action of heat. Gold, silver, &c. are metals ; and iron &c. are minerals. Native copper sometimes united with silver. This asphaltum contains no traces of metal, except a little of the oxide of iron in the ash. A mine is an opening made into an ore or mineral of any kind. When ores or minerals are in the ground, it is not a mine until it is opened. This material is used

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in the United States for the manufacture of gas. It contains so much volatile matter, it is valuable for gas. Resin is used for that purpose. Where it is used in manufacture of gas, and resin is used, it is a substitute for it. Amber is a fossil resin, and fusible; it melts at about 560. I saw a piece melted last night in a candle, by Dr. Wetherell. I have heard of Professor Robb. He has a very fair reputation. Dr. Ure is as good authority as an analytical chemist.

*Cross-examined by Johnson.*

I came out in 1848. I practised the medical profession since 1839. I taught in chemistry and geology before I came. I commenced the study of geology in 1845. I was first employed to deliver lectures on geology in the Provinces, before I commenced the study: I have lectured each year in Ireland and United States. My practice is more of a chemist. I stated in the report to Mr. Legal, that it could only be in one of two predicaments—a highly bituminous coal, or carbonaceous asphaltum. I meant that it contained a little of uncombined carbon. The compass I had, worked irregularly in the mines, but kept its bearing generally. The horse is on the eastern extremity. The only experiments I made here, were with regard to solubility. The shales appeared to be bent, and curved inwards towards the vein. I did not see two ends of the same piece touching vein. I did not see the rock outside the shales. I judged of the dip by the shale alone. I have not known any bed of coal in an anticlinal axis: I have written a work called the hand-book of useful arts. I say a seam of coal cannot be in an anticlinal axis. [Johnson asks if he has not written a certain statement.] An anticlinal axis may exist in a coal field, but a coal seam cannot exist in an anticlinal axis. A coal seam may lie in one of the plains of an anticlinal axis, but it could not be a bed of bituminous coal. The heat which would upheave, would deprive it of its bitumen. Substances fused, and cooled under pressure, will have a conchoidal fracture. There is shale above, as well as below. The inclination of either side would constitute a roof. The disposition of mine is a fractured rock, and the substance entered from below. The shale must originally have been the bed of a stream. The shale must have existed previously, and been upheaved. The upheaving of shale and injection of mass may have been contemporaneous. The break must have been from above. I have seen the fishes: their impression on the shales, and very much bent. I would not attempt to account for apparent contortions of fish. The position of fishes is a positive proof that shales at one time were horizontal. The majority of coal fields are formed by drift. This shale is highly

bituminous. I don't think we know all the causes which convert vegetable matter into coal. Plants are found in coal fields in northern regions, which do not now grow in the north. Water is necessary to produce decomposition. The lamina of this article cannot be discovered by the microscope. I saw lines of cleavage. I saw no evidence of mineral charcoal in the mine. I saw iron pyrites there, and I have no doubt it is in asphaltum mines. This seam bears evidence of heavy lateral pressure. After the mineral injected and cooled, the strata would settle upon it and crush the ends; this would take some time. Shale which splits readily will bend. I saw no traces of fusion in the shale; it must all have been soft at one period; traces of vegetable structure found in every coal, and the discovery depends upon the manner of examination. The usual way is to grind coal thin, and examine it under glass. There is difficulty with brittle coal in grinding it thin enough to discover vegetable structure. I first examined asphaltum at the close of last year, or beginning of this. Asphaltum does not present any laminated structure; and if what we call a lamina was found as in coal, I would say it was coal. The lamina occurs when it is becoming hard, and pressure then would crush it up. (As to three grounds)—I am not aware of electrical coal. I think no asphaltum would require to be heated more than once to obtain a perfect solution. I don't think the alcohol would solve more of the Cuban, than of this; but I have not tried it. I believe fifty per cent. of Cuban asphaltum would dissolve in ether; I have not tried it. I think I could say it would entirely dissolve at heat of boiling water (212). I think in the turpentine the Cuban asphaltum would dissolve. I weighed the substance before and after. I knew the substances would not wholly dissolve in the fluids. There are minerals that are infusible from ordinary means. I do not think coal could be fused. If bituminous coal be confined and heated, a bed of anthracite would be left, and bitumen thrown off. A naphtha spring is quite independent of a coal field. Naphtha generally arises from decomposition of bituminous shales. I think this vein is not placed above the old red sand stone series, but below on the silurian. I do not know that palioniscus is found in silurian series. I believe it to be rare to find such a quantity of palioniscus fishes on the silurian: they run up to the chalk formation, and die out there. I know some coals more dense, and one less than this. I do not know any coal except this, which does not soil the fingers. A chemist may be mistaken between melting and decomposition. If oxygen and hydrogen combined, coal would soften and swell. [Looks at hard specimen produced from *defandani*.]—I presume this is a variety of cannel coal. I see the

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conchoidal fracture, but not the laminations. Asphaltum mine traverses shale in Trinidad, and then passes between shale after having penetrated it. I don't know of any coal possessing more volatile matter than this. Petroleum and asphaltum are composed of the same constituents as coal: sometimes more carbon, nitrogen and hydrogen in coal, than in asphaltum. The question of whether asphaltum possesses more or less of oxygen, nitrogen and carbon, does not affect the question. I would not depend upon an organic analysis as establishing its character: such an analysis determines singly the atoms which constitute the body. In this case, I would depend upon an organic analysis. I could tell by an organic analysis sugar from starch, or otto of roses from spirits of turpentine. I have never known asphaltum used for blacksmiths' work. All the known specimens melt at about 212. I think this will melt at 600—I mean it will drop. I think between 2 and 300 degrees additional would be required to melt this like the other. I am quite sure it would melt before platina would become red, which is I think a little below 800. If you take crust off bituminous coal when heated, you can take out a soft substance which you can make an impression on. I don't know of asphaltum used alone for gas. I looked for plants and found none on the roof. I looked to floor for fire clay and found none. There are coal beds where *stigmara* is not found. There is a coal bed in the United States resting on igneous rock: it is not bituminous coal; its position as a bed is not sufficient to determine it as an asphaltum, but to determine it not to be a coal. I mean the peculiar age and position of the rocks. I found the old red sand stone lying above it, but not at the mine, but on the right hand side of the mine passing up the creek. The old red sand stone I saw was about two and a half miles from the mine. I judged from the color of rock, and its lying over the seam of coal—there were gray and brown shales both above and below it: its dip was south westerly, probably about 40°. I had given evidence on one occasion that this was asphaltum. There is plenty of pyrites on the iron stone. I do not know of coal beds without impressions of plants on the roof. In large glass furnaces they heat up to nearly 2000: it must be up to red heat about 700. To melt the glass flask, the point of low redness is about 700; at that heat Cuban asphaltum would boil up very readily. If the glass was fused, a portion of it must be decomposed: this is a combustible mineral.

*Re-examined by Kerr.*

The circumstances that produce an anticlinal axis, are attended with intense heat, and if in the neighbourhood of a bed of coal it might

dissipate it completely, and if strong enough to rupture the shale, the deposit of coal could not lie down its edges. When we say that a district or country abounds in minerals, we mean that it contains minerals capable of being worked and applied to economical purposes.

*Doctor Joseph Leidy.*

I am a Physician. I reside in Philadelphia—at present I am engaged in teaching physiology and anatomy, and microscopic anatomy. I have examined this material in dispute—from the mine, from Dr. Wetherell, and from the Cabinet of the Academy of Natural Sciences: I have been ten or twelve years engaged in this. All the specimens I referred to, I found the same, and the specimen from the Court. I gave Dr. Wetherell a specimen with my initials: I saw him fuse it and seal it. I commenced several months ago and examined many portions, that there might be no mistake: I found them amorphous and structure less like glass or amber. I also examined Cuban and Egyptian asphaltum in Cabinet of Academy of Natural Sciences, and they presented same appearance; and also examined anthracite and bituminous, and cannel coal. I found anthracite entirely composed of vegetable remains, and can shew the constituents now. [Produces a box of glasses and applies a microscope—all the jurors look.] This is from the hardest variety of Pennsylvania anthracite: this power is about 700. You cannot distinguish these by the naked eye; this has no vegetable structure, and it transmits light. I have Cuban, Egyptian, and New Brunswick asphaltum—all are translucent, and have an amber brown colour: this is the Egyptian. [Judge and Jury examine it.] This shews a reflection of light, and no appearance of vegetable structure. This is the New Brunswick material: it is brown, but darker than the other. This is Cuban—translucent at edges, and brown like the others. In preparing the anthracite, it was first burned and the ashes put in the glass, and they shew the vegetable structure. This is cannel coal shaved off in the same way, and is perfectly black, and transmits no light. There are no appearance of vegetable structure in this. I tried to burn it, and obtain ashes to ascertain the vegetable structure. I tried common bituminous coal, burned it and obtained vegetable fibres, which I have here: this is it. [Examined]. I have pieces of Cuban, Egyptian, and New Brunswick asphaltum, shewing them structureless and amorphous. Adjourned till Monday, 10 o'clock.

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**MONDAY MORNING, 10 o'clock.**

*Doctor Leidy's examination resumed.*

This substance is amorphous like the Cuban and Egyptian asphaltum, which I will now shew by microscope. I mean by amorphous, without structure. [Looks at microscope.] This is a specimen of Cuban asphaltum under the microscope. You can see no bodies in it; it reflects light.

*Examined by Judge and Jurors.*

Looks like a piece of brown flint, transparent at edges. I will now place beneath the microscope a piece of the New Brunswick material; it is quite amorphous, and same colour as Cuban—it being amorphous and transmitting light: if any vegetable structure it would be observed; but I have never been able to discover the least tissue of any vegetable matter in any part of it. I examined a piece of cannel coal, Lancashire, and it was stratified or laminated, and was black and opaque, and transmitted no light. I did not look for vegetable structure in cannel coal; my only object was to ascertain whether this was asphaltum. This substance has the appearance of having been run in a state of fusion. This is a piece of shale from the mine; the substances on the broken edge of the shale have same appearance as the other. The sides of the crevices correspond so closely, that they must have touched, and some of the substances between must have been in a fluid state merely, and not liquefaction, which would have shewn vegetable fibres, or traces of vegetable or animal remains, if it had been water. The transverse lines as fine as a hair. Between shales are filled with substance, which must have been in a melted condition. I tried to dissolve it in chloroform: this is a specimen in chloroform—a good deal of it dissolved. I then tried Cuban and Egyptian asphaltum, which dissolved wholly. This substance not being wholly dissolved in chloroform, is no evidence of its not being dissolved. This is a piece of cannel coal in chloroform—in same time, and not at all dissolved. A piece of bituminous coal and no solution. To shew that it is a solution, and not a mere suspension, I have a drop of each in these bottles. [Put under microscope.] This is the New Brunswick material—it shews the brown colour; this is the Egyptian; this is the Cuban, which resembles the Egyptian. I examined a portion of this mixed by Edgitt with paint: it transmitted brown colour. I tried experiments on pieces obtained by myself from the mines, and have no doubt the material is identical with what I obtained in Philadelphia. The residuum of the material is similar in appearance to Cuban and Egyptian: I am satisfied this substance does not contain vegetable

structure. The common English bituminous coal presents the vegetable structure. I tried it by burning it to ash, and examining it in ash. I have also seen them without burning it to ash. Reasons why I think this is asphaltum : because it is, 1. Amorphous; 2. Translucent; 3. Light is of brown colour. No appearance of stratification; no appearance of vegetative structure, and being soluble in same menstrua as other asphaltum : its being fused, not destroying its appearance. I examined a piece of the asphaltum fused by Wetherell, and that presented the same appearance. The result of my experiments is that this is no variety of coal, but asphaltum.

*Cross-examined by Gray.*

I never saw coal nor heard of any without any vegetative structure. I do not mean to say it is an incontrovertible axiom that no coal is without vegetative structure. If such were shewn, one of my reasons would be gone. Vegetable substances may be so decomposed as to discharge all remains of vegetative structure. If all traces of vegetable were gone, it could not be coal. There may be organic matter not organised. If it were reduced to a perfect state of decomposition, it would be absorbed into the air or surrounding soils, and could never be solidified. The lustre depends upon its uniformity and fineness of particles. If vegetative structure were reduced to a fine condition, it would produce a smoother and more lustrous coal. In another instance, the Cuban or Egyptian drops might present more air bubbles than the other. The other now presenting more, is accidental. The darker appearance of the New Brunswick material is no evidence of the article being in suspension. I did not try to get ash from the New Brunswick material. I could not determine any better by ash than without; because its being amorphous and transmitting light, I could see there was no such substance. I have seen brown coals and they all present the woody structure. No coal will produce brown light and be amorphous; these two must go together to make asphaltum. The brown coals will transmit a brown light, but they are not amorphous; they are brown because of their imperfect carbonization. The brown is characteristic of asphaltum; but in brown coal it results from imperfect carbonization. Where perfect, it is black. Cuban asphaltum presents the same appearance as this. When Cuban is pulverized and put on paper, it looks brown. This not compared with other as to brown color; it would to any ordinary observer appear black. There might be a substance brown in color and destitute of structure, which may be neither coal nor asphaltum. If Dr. Taylor were to say coals could be found without vegetative structure, I would not doubt it. If Dr. Mantel were to state it, I could not doubt it. If I were to see a

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substance brown in color and not having a vegetable structure, I could not say it was not coal. I did not examine cannel coal for its structure. Gold leaf under microscope reflects green light, and without it. Oil of turpentine and oil of lemon contain the same elements in the same proportions. Starch and sugar differ only in the arrangement of their particles, though alike in component parts. The same constituent parts of asphaltum by different arrangement might produce a different material, and therefore this is one variety of asphaltum, and Cuban another. Thence would you make sugar a variety of starch. You might call it so. A difference of color may depend upon absorption of rays of light. There are complimentary rays of light,—they would be effected by different substances. The same rays passing through the New Brunswick article and Cuban, produce different degrees of color. I have examined coals for years past, for curiosity. These I examined a few months ago, for the purpose of comparing these substances. The first time I saw it on the Academy table, I said, oh, what a magnificent specimen of asphaltum! I think it would entirely dissolve in chloroform. Oil of lemon will dissolve to any extent in alcohol, but turpentine only to a small extent, and yet both are called essential oils. There are substances from which you can take the color and leave the substance, but it is not so here, for the remains are the same color as before. A grain of iodyne would color a large quantity of water. I think 30 gallons of water if chloride of added. I am 28 years of age. I have read that there are coals that in some portions shewed vegetable structure and some not. I would not consider a different shade of brown as making a distinction between coal and asphaltum. The pieces put in the chloroform were all in lumps. They have been in for six weeks. Alcohol might dissolve one seventh of turpentine immediately, and if so it would take seven successive portions to dissolve all. Then seven parts of alcohol to one of turpentine would dissolve it instantly.

*Re-examined by Milner.*

Air bubbles are accidental in microscopic examinations. A curtain of gold leaf would transmit green light. [At Judge's request he puts a small portion of residium of bottle of New Brunswick article under microscope, who examined it; it has lost none of its color, it has same brown appearance at edge.]

*John M'Clay.*

I am a native of Scotland. I left twelve months ago, this July. I am 44. I was a coal and iron miner—over 30 years at it. I have been engaged in many mines: in 20 different ones in Scotland. The



mines are in the parish of Hillsborough. Coal mines have a general uniform appearance. I have worked in Pictou, in Ohio, Susquehannah, and other places in States. I commenced working in Albert mines the last of March last, under Mr. Cairns. When I first saw mines, the first impression was singular. I never saw minerals in such a state of confusion—I mean the strata and metals: in all the other coal mines the coal lay parallel to the strata, above and below. Here the vein is vertical, and the reed of the vein is horizontal. The strata of metals, what is called roof and floor, is sometimes 45°; sometimes convex, sometimes concave. This has no roof or floor. I have found fossil fishes as much one side as the other, but I never found any fossil plants. I never searched for them; two specimens of plants were shewn me. In all other coal veins fossil plants are very common. I have seen little shoots running off into the strata, but I can't tell how far they go. I never saw in Old Country or States any such shoots from the main vein. In other places coal formations are parallel to strata above or below, and cleavage is parallel to bed of coal. Not so here. The strata here, stands at right angles to the vein. The plants I saw were in some cases similar to what I had seen before. I believe they were got at the mines. I have worked in Renfrewshire, in Honlot mines. I visited that as assistant surveyor. It lies in the same fashion as other coals, and has all the characteristics of coal deposit. There is a stratum of lime there which is different from any other. I think I have not seen any mineral charcoal in this mine.

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**ATTORNEY GENERAL—FOR NONSUIT.**

**GROUND 1st.** The two first counts state forcible entry and detainer, and plaintiff has shewn he is a lessee and not a freeholder, and therefore can't sustain those counts.

**2d.** Under third, fourth, fifth, and sixth, plaintiff shews that at time of his entry neither title nor possession.

**3d.** Has shewn possession of *locus in quo* at time in defendant, under Duffy, who carried on operations long before purchase from Milner.

**4th.** Defendant merely expelled plaintiff from mines and nothing more. Binney went out 9th January, and Cairns forbid him; and after plaintiff dug mineral was forbid by Cairns to remove it.

**5th.** Purchase by Milner, was purchase of right of entry alone: Duffys had sold out to Cairns: he was in quiet possession: void by statute and common law.

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6th. Applies solely to seventh count for taking asphaltum—no evidence to shew plaintiff's property, and therefore cannot recover. Asphaltum is a mineral: grant excepts it, whether coal or not.

The plaintiff had never been in possession.

As to second point: plaintiff had not possession of mines, nor had he possession of that part of *locus in quo* we were in possession of. They have treated us as holding adversely to them.

*Johnson on same side.* Referring to third count—party must shew possession at time; and if defendant in possession before, plaintiff could not recover: very act complained of as trespass would be a possession. What might be an act of trespass under George Steves, could not be as against present plaintiff. At time of the transfer from Steves to Milner, and from Milner to Gesner, defendant in adverse possession not proved. Defendant went an inch beyond Duffys possession. Our possession is a continuation of Duffys possession, and transfers void under statute.

*Palmer.* Only point, point of possession: The leases from Steves are mining leases. The plaintiff must revest himself with possession before he can recover. *Ros.* 486: working one part of mine, possession of the whole; they can't seek to recover for trespass to mines.

*Mr. Kerr*—stopped by Court.

*Judge.* I decide that that there is evidence to go to jury, even as to adverse possession, and that I cannot stop the case.

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### Mr. Gray opens the defendant's case.

Defendant in quiet possession. Not simply whether coal or asphaltum, but our first position we take is, at time Binney and others, common lot, we were in quiet possession with consent of owners of soil; and that plaintiff trespassed on us; and if they had not possession, they cannot maintain action; if we were in adverse possession when plaintiff purchased, then plaintiff cannot recover.

Another point. At time Milner got lease of Steves and Gesner, they knew transfer of Duffys to Cairns.

We were in possession of that which was our's; they came on, not to settle the land, but to work the mines; that purpose of mining was an invasion of our rights, and if we drove them away it was defending our property.

We will shew that Cairns disclaimed interfering with the use of land. Under George Steves' grant, not entitled to article, even if asphaltum, for all minerals reserved.

We are entitled to sell the mines under our lease, and to a right of entry for purpose of working.

Again. If coal, we are clearly entitled to it ; for they don't pretend to claim coal.

We will shew that this is coal, and not asphaltum. The plaintiff himself treated it as coal until his interest to call it asphaltum. When he was employed as Provincial Geologist, (*Gesner's Report* of 1841, pp. 27, 28), coal was found most abundant above Beave: Dam, about nine feet thick, quality of coal superior, &c.; a quantity collected and ignited, and burned with great splendour. (*Gesner's Report* of 1840, p. 66), on lot No. 3, a quantity of cannel coal found at bottom of small ravine, five or six miles from mine. We will shew you that it is coal and not asphaltum. [Reads from paper read before American Institute, of coal mines in Cuba, in a vein, thrown up at once, wedge shape, small veins passing off, black and lustrous.

We will shew soft substance never found in the mine. Dr. Taylor says by no means necessary to establish as coal, that vegetable structure should be found. We are entitled as *bona fide* purchasers.

The conveyance from John Steves to James, Dawson, and Robert, confers no right to mine.

In conveyance to Milner, they only give right they had, and not right of mining; and yet Milner covenants to pay 1s. per chaldron. If one hundred chaldrons not raised, lease to be void; if fails, lease to be void; if succeeds, a good speculation.

We will shew from Crown license to Duffys, &c.

*Taylor's work*, introduction, 93: The most perfect coal has undergone liquefaction—*ibid*, 636.

#### EVIDENCE.

Crown license to John Duffy and Peter Duffy of mines, &c., for twenty five years—gold, silver, &c., and other minerals, &c.—one square mile. Dated 11th January, 1850. Assignment of lease from P. and J. Duffy to Cairns; dated 13th December, 1850; acknowledged, 21st December; registered, 28th December.

*Kerr* objects, that by Act of Assembly conveyance must give interest in land before admitted by acknowledgment, and should be proved by subscribing witness, and that it gives no interest of land.

Judge admits assignment, and reserves point.

Grant offered from Crown to John Martin, 3rd December, 1833, of lot No. —, of lot B., 200 acres, adjoining No. 1.

*Kerr* objects, that it is irrelevant and has no bearing on the case. Judge admits the grant. (Read in evidence).

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*Bliss Botsford, by Attorney General.*

I am attorney for defendant. I served notice to produce on C. Milner. I served copy of this affidavit and notice on Mr. Thomas Crane, in Mr. Milner's office. He attended the office and received the papers on 5th July, 1852. I subsequently saw Mr. Milner, who remarked that I ought to have brought a wheelbarrow to bring the papers; this was immediately after I served on Crane. I served copies of the deeds mentioned in the notice.

*Cross-examined by Kerr.*

I don't know what authority Crane had in Milner's office—in post-office: he keeps post-office too. I think I asked Milner about the papers, when he made this answer. I have served many papers in the case. I understood him expressly to refer to the papers I served that morning: he said it was all right, and that I ought to bring a wheelbarrow or waggon. He met me and served me with papers on the road.

Notice offered in evidence, and affidavit annexed.

*Kerr* objects to its being read, as irrelevant.

Judge admits evidence.

Copy of this deed served, John Martin to Frederick Steves, dated 9th April, 1836; acknowledged same day.

Two hundred acres, (same lot as grant.)

Frederick Steves and wife to Robert M. Steves, £100; dated 25th November, 1844; acknowledged 25th November. Lot B.

Robert M. Steves and wife to C. Milner, £150; 14th November, 1850—one undivided moiety of lot B; acknowledged 14th November, and registered same day.

C. Milner and wife to Robert M. Steves, 1s., 17th December, 1850; acknowledged 31st December, 1850. Release, quit claim, &c.; one undivided moiety of lot B.

Robert M. Steves to Edward Allison, £1100; dated 14th February 1851; offered in evidence.

*Kerr* objects to admission, being too late after issue joined.

Judge sustains objection, and deed rejected.

*Reuben Stiles, by Attorney General.*

I reside in Hopewell. I am deputy surveyor upwards of 20 years. I know where mines are. I have known the land there these ten years. [Attorney General reads description in Duffys lease.] I was called upon to run out that, and ran it out according to the lease. I did not run the north side, and part of west end. I know George Steves'

grant—part of it is within the bounds of that lease. [Reads description of four acres.] I don't know that except from hearsay. I don't know whether mining lot includes that. I know where Cairns is at work: that place is within the mining lease. I ran division line between Martin's and George Steves' lot. I think the buildings occupied by Cairns are on lot B, Martin's grant. There is one shaft sunk on Martin's grant. The shaft opened by Duffys, and occupied by Cairns this summer, is on George Steves' lot. Duffys were at work a year before Cairns went there, and Cairns is working about the same place. Cairns went in after Duffys went out. I ran out the lease for Cairns. I had a chaldron from Duffys and burnt it, when they first opened it in 1850. I got it to burn in a franklin. I found it answered a good purpose. I bought it as coal. I worked it in a blacksmith's shop myself, welding iron and steel. I worked it in 1851—part of same; it answered very well, but not profitable to work in a shop. It does not last, makes too great a blaze, and rather light. I saw Gesner several times in this Province, when making geological surveys. He called it coal. I first saw the coal at Mr. Edgitt's. It was black the same as this.

*Cross-examined by Kerr.*

I had a copy of lease when I ran out lines. I knew George Steves' lines. I ran some lines for him. I ran line between him and Martin five or six years ago—I think at request of Frederick. I won't be positive as to running a line for John Steves. I began at south east corner of John Steves' lot. That line had been run out before. I had been round all these lines before, and had measured across the front of all the lots. I ran from south east corner, due west 15 chains, then south 50 chains, then west 80 chains, then north about 40 chains, then came to end of 15 chains, and run about 30 chains north, across John Steves' grant, a mile square—contains 640 acres. I ran out lines a year ago this summer, after Duffys left. I know where Duffys ran in a level first, and then they went into the slope. I paid Duffys 15s. for the chaldron. My father kept blacksmith's shop, and I used to work sometimes. I mended some chains and made some horse shoes with this material. The shop was occupied by Anderson. Anderson got out of coal, and I let him have some of mine; I will swear no charcoal mixed with it; I never saw it run through the grate; I burned it sometimes with wood. I don't think this mine was found till Duffys found it in 1849. I did not hear Dr. Gesner refer to but one kind of coal, and I believe it was like this: small pieces picked up in the brook. I understood Dr. Gesner, the piece he

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had, came out of Frederick's brook. I will swear this was not the lump shewn to me: it was brighter; it was so long ago I can't swear to size.

*Re-examined by Attorney General.*

The line between lot B. and No. 1, runs across the lease, and I have been on it since, and it goes between the two shafts.

*John Duffy—sworn on voire dire.*

No interest except what appears from lease. Lease to myself and brother Peter. After we bought lease, we began to mine. I understood I worked on land of John Steves.' Same place where William Cairns is now mining; where he is now taking up, is within the compass of where we worked. I went to John Steves and told him I had a mining right.

*Gray* asked, did you go upon the ground with the consent of any person?

*Kerr* objects. That notice contains no license, they can give no evidence of it.

*Judge.* I sustain—can't be put in this way.

*Cross-examined by Gray.*

I went into possession in November, 1849, and continued to work there. I knew where the land was. We commenced work about the last of November, 1849; we went to work clearing off and digging, and worked that winter, and got out about 500 chaldrons: same place where Cairns is now at work; we worked till the year 1851, when we sold to Mr. Cairns, in December, 1850; but our men were there the 1st January 1851. I was not there when handed over to Cairns. My men were taking care of the place, when I was in Saint John. For £3,500 we were to give what stated in deed. We had coal there dug up, and we had the benefit of it, and sold it to Allison. After we sold, Cairns had full right to the mine, and we have not worked at it since, save to remove coal sold to Allison, which was removed by my brother. There was no actual possession of the land when I went there in 1842. I think John Steves then owned it. I told him I had a lease for mining there.

*Kerr* objects to what John Steves said to him, by way of permission or license to enter.

*Attorney General.* Plaintiff claims on deed long after such possession given, and this does not come within rule of law, as to license.

*Mr. Kerr.* The evidence of license cannot be gone into, because John Steves is not a stranger; but one through whom we claim—and no notice of license.

*Gray.* We deny any trespass at all, and to plead license would be to admit trespass. Adjourned.

TUESDAY, 27th, 10 o'clock.

*John Duffy recalled, and examination resumed.*

I think I made an error as to bargain with Cairns. Besides what mentioned in deed, Cairns was to take the buildings and implements such as he wanted, and was to give what they were worth, as to be agreed upon by ourselves. This was over and above the £3,500. I can't say that the amount was settled. I was satisfied. We had a small house and a gin house. I don't know the house is there now. I was there eight or ten days ago. I think the cook house is removed. Most of the buildings there now are on the Robert Steves' farm. I went to see John Steves.

*Kerr* objects to any evidence of consent of John Steves to enter upon the land.

*Attorney General* submits that he has a right to shew the agreement between witness and John Steves, by which he went upon the land, although that agreement includes Steves' consent and permission to enter, John Steves being the owner of the land at the time. It is contended we should plead leave and license, but not so; we may be tenant from year to year, or for three years, under parol license. Only necessary to plead license, when licensed by plaintiff himself.

1 *Ch. Pl.* 538—"A possessory right can be shewn under the general issue." 541—"Under general issue defendant can dispute plaintiff's possessory right." If we shew plaintiff has no possessory right, we cut at root of action. Defendant must shew superior right in himself. We can give parol lease for three years. If we can shew right to enter under former owner, we cut down plaintiff's right. 544—"A license from plaintiff must be pleaded specially." 3 *Ch. Pl.* 1106—Form of license from plaintiff. If license was from plaintiff, we would be obliged to plead it. 2 *Stark.* 1117—Under general issue defendant could give evidence to shew time of trespass. It was no trespass at common law. Suppose Steves gave us lease for years, we could shew it without plea, or that he had any title or right to possession, or tenant under plaintiff, or in common with plaintiff. I assume we can shew Duffys tenant from year to year under Steves; then we can give it in evidence in present case, that he was lessee for years, of land on which trees grew. This is no license offered in evidence, but a right to occupy. We don't seek to give evidence of a license to commit the trespass complained of. We will give evidence, to shew a right of possession in Duffys anterior to plaintiff's right.

*Gray.* By pleading license we admit prior right in plaintiff; but

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we deny that, and we can shew under general issue that plaintiff had no possessory right. Again, it is evident of adverse holding at time of plaintiff's acquiring his right.

*Johnson.* Suppose pleaded that Duffys entered under Steves, and we under Duffys—would not be demurrable for Steves conveying—would be put an end to by Steves' conveyance. Steves' assignee would take subject to Duffys tenancy.

*Palmer.* If we shew agreement between Steves and Duffys as to possession, it is an "estoppel in pais:" 2 S. S. C., 467, *American* edition, *American* note.

If we can shew that by permission of Steves we were induced to erect our building, they are privies, and are estopped.

*Kerr in reply.* The notice of defence mentions assignment of lease from Duffys, and this appears in assignments themselves. If this were action against Duffys, it would be a different thing; but this is against Cairns for trespass at different times. If tenancy at will, the sale would revoke the tenancy. It must be a license or nothing. Their own assignment says, that Duffys will endeavor to procure leases from owners of soil.

Judge decides to allow evidence of permission to occupy by John Steves to Duffys: that is admissible as evidence to negative plaintiff's possession, and is evidence of an *estoppel in pais*.

*Duffy's Examination continued.*

When I applied to John Steves, he said go on and go to work; he knew what my object was—to mine. I went on and went to work; this was last of November 1849. We went on and put up a house, opened our mine, and carried on mining operations until the end of 1850 or beginning of 1851. I went to John Steves in November 1850, to settle: he said he thought it was time he was getting some remuneration, I asked him what he was going to charge: he said £10 to that time, a year. I asked him how we should go on in the future: he said I could go on till spring. I paid him £5, and told him to call on Squire Lewis for the other £5: this was in November 1850; after that I sold to Mr. Cairns. I told Cairns I had paid Steves £10 for the previous year. John Steves was out in the winter of 1849 and 1850, while we were at work; he could not help but see our work. We got up a considerable quantity, and he saw the material we were raising. During the first year we built a house, and gin house, standing on Steves' property, and cut trees and did what we liked. We sunk a shaft, and we had a row of coal shoots on this ground for the purpose of loading coals on sleds; these were up when



Steves was there, and coal shale was thrown out on the ground, which I have no doubt he saw. Our men remained there till Cairns went out and took possession. The material went under the name of coal : we generally sold it as coal ; we sold it to settlers about here : some at the Bend, some to Shepody, and some here. I worked a little in forge once or twice myself ; I sharpened picks with it. I never raised coal under any other lease.

*Cross-examined by Kerr.*

I paid £5 for license. I purchased lease. I think sale 20th November, 1849 ; license came to me in the winter. I went to work before I got license, last of November ; we made no survey by surveyors at that time ; we went back one day, or twice, before we got license ; we found it out in August ; we commenced working last of November. The license came down in winter. We were on one or two days before we asked any one ; we bored with an auger. I think in November I saw John Steves before we took any men in, and we took men in about last of November. I told him we had a Crown right, and that we found coal there ; and I thought I would come and ask liberty from him. I told him I wanted liberty to go to work : he told me to go on, and go to work : no agreement as to how long I should work, or what space I should occupy. I think his son John L. B. Steves was there—I won't be positive ; some of the family were there ; I can't be positive who ; the women were in and out. It was in day time I was there, I think in forenoon. I think we ran a line partly round by Stiles' I think. I think Cairns sent for him to know line between our license and his. He did not run the north line and part of west line. We first went to work in south hill, and then we went to work in north east hill. We went in one or two hundred feet into south hill before we left. The north east hill is from two to three hundred feet from south hill. We put up coal house opposite to south hill. We went from two to three hundred feet into north east hill. We quit after that. We shipped off some of the material to the States. We were the first who dug any quantity known for use. We sold probably thirty chaldrons in the neighbourhood. I had seen small pieces for a number of years before. John Steves was there when we were at work. I am positive when working into north east hill he was there. I don't think I ever saw him at the mine after that winter. He was out more than once. I thought he came out to see how we were getting on. I don't think I saw him there after we quit in March. We began again during next summer ; commenced between the two hills—that was the slope : we got out coals there. I was in hopes of

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making it out asphaltum. I might have called it asphaltum. We discharged our men in 1851, I think. Our tools we gathered up and took to Robert Steves', about half a mile. We took away all but cook house. When we went to work in summer of 1850, we did not obtain further leave from John Steves. When we sold our property, we had men at work—I don't know exactly how many. I never hindered John Steves from coming on his land while I was there. When I went second time, in November, to John Steves, he commenced the subject first. I had no idea of selling at that time. I can't say what time in November. I was there afterwards on the 24th December. I asked him what his charge would be; he said it would be £10. I don't know he had been out to see what damage done to land before. I asked him how we should get on for the future, and he said I might go on till spring. I did not apply for any body else. On 24th December I made him an offer of £5 if he would not convey to Milner, and he refused it; a little more was said. I offered him £5 if he would not sell till Cairns returned from Saint John. I did not want him to make any bargain till Cairns came up: it was agreeable to a clause in my agreement to Cairns that I applied to him. I told him I had sold to Cairns, and of the clause in the lease, that I would use my influence. I did not succeed in my endeavours. John Steves wanted me to have an agreement, to take off, or give up, or something to that effect. I think he mentioned coal, and my tools, or to that effect. I did not tell him I would remove them. The coals went to pay a debt we had arranged through Mr. Allison. He wanted to give me a writing to take off my things. I understood him he was leasing to Milner at that time, and I expect his object was to break the arrangement with me. He did not say that I might remain on till spring, unless I sold out to any body else. I put shales on ground. Can't say how many trees I cut at that time. My brother John was not with me at either time at John Steves'. John Steves did not complain of my cutting his timber without his consent. I told him we were cutting away there; he said I know you are cutting away: this I think was when we settled for the £10. He said I might stay there till spring, and my view of it was, I was to go on and work as usual. I think John Steves told me I did not own the land; but he did not tell me I had no authority to be there. I did not tell him, on the 24th December, that I had no right to be there. I don't think he ever said I was digging coal, and not asphaltum.

*Re-examined by Attorney General.*

I thought if it was asphaltum, it would be more valuable; but I could

not succeed. I had a man by name of Stewart working there, and two of John Steves' sons hauling coal, James and Dawson. While we were at work before, I offered him the £5; he said he had been waiting some time. When I offered him the £5, he did not say whether he would wait or not. Milner was in adjoining room at the time. I think Squire Steves was in during the day. When I first went there, I was in room where Milner was, and came out. I made arrangement with Steves for both myself and brother.

*Peter Duffy, by Gray.*

I am brother of John. I was on ground the 9th January, when Binney came on. Before this we had conveyed to Cairns, on or about 1st January, 1851. I went in for the purpose of clearing out and dismissing my men, and putting things out of the road. I handed him over the key of the cook house, built opposite the mouth of the north east level; the house was about 150 feet from slope: we built it. I handed over such tools as Cairns wanted. There was a gin there, and I agreed for the price of it, and gave it up to him. Before this we had assigned our right of mining. Afterwards, on the 9th, Cairns forbid Binney and others from interfering with his mineral. He stated to them he was owner of mining rights on ground where they were, and not to meddle with it. Mr. Brown, Cairns' foreman, was present. Binney said he would take this opportunity of forbidding Cairns; he said something about silver and gold—that Cairns had a right to them. Cairns said he would pay all damage. I think he said if he was a trespasser, he would pay damage. I always considered it a coal mine. I had doubts it might have been more valuable than coal. I was not willing to deceive myself: if it had been any thing more, I should like to have known it, as owner of the mine. John Steves' sons, James and Dawson, and J. L. B. Steves drew coal for us when we were working; they saw the trees cut and shale on the ground; the hauling was in winter. When we transferred mines, we had about 200 chaldrons on the ground, and I hired teams, and drew it away.

*Cross-examined by Kerr.*

The greater part of our coals were put on Edgitt's wharf in heaps: were in a different place from Cairns'. I think we got nearly all away in January. I might have called it asphaltum, but I had my doubts. I left behind some pots and kettles, and saws and augers. I did not understand Binney sufficiently to make sense of it at the time. I did not hear Cairns say he was a trespasser, but that if he was a trespasser he was willing to pay the damage. Milner was there in

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November 1850. He said when we came to the adjoining lot he would get an injunction out of Chancery and stop us : that was about 14th November, I think. I did not know there was any dispute about asphaltum or coal. Milner said he would raise a question. There was no dispute before I sold to Cairns. I think he said he would raise a question whether it was a fossil, or mineral, or asphaltum, or coal ; and I told Cairns that Milner said so before I sold to him. It might have influenced me in selling out. I probably called it asphaltum before that : if I ever called it asphaltum, it was in a joking way. Asphaltum was used as a bye word. I think the jokes and bye words were after Milner said he would raise the question.

*Re-examined by Gray.*

I reluctantly came to the conclusion that it was coal and not asphaltum. I can't say what quantity Cairns had out on the 9th January : it was a small pile, lying on top of shale we had thrown out.

*Archibald Brown, by Attorney General.*

I have been in this country three years. I am in Cairns' employ since 1st November, 1850. I have been in charge of Albert mines since 30th December, 1850, under William Cairns. I know J. and P. Duffy. I was present when they handed over mines to Cairns. In first place cooking utensils and mining utensils—then the gin house where coal hauled up, and last of all the slope and mine itself. On 30th December, 1850, I had two men along. I had been exploring six weeks in neighborhood, before and since that time. I have worked since at the mines. From that to 9th January, we were sinking a shaft about 50 feet from mouth of the slope. It descends perpendicularly, and goes into the slope where Duffys worked. We had the shaft down 27 feet on the 8th of January ; we were then 15 feet into coal ; on 9th January we had no less than 25 men at work. We had all the buildings which had been handed over : I was present. John Robertson and his son, Bowman, Downie, and Binney, came on with picks and shovels, and commenced shovelling snow about 250 and 300 feet from our work—exactly on top of the seam of coal. Cairns, P. Duffy, and I went up. Cairns said he would forbid them interfering with his minerals, as he was owner of the mining lease on which they then were ; and he would hold each and all of them responsible for what they would do. Mr. Binney said he would take the opportunity of forbidding him from trespassing on our soil. Cairns said I will pay all damages if I am trespassing, but I do not know that I am. I don't think anything else passed. I made a memorandum at the time, and I have referred to it a dozen times, and I cannot be mistaken.

After we left them, they went on sinking the shaft, and sunk it about 12 or 15 feet; it went through on the Duffys old level, and this was part delivered up to Cairns before. They had taken about one half a chaldron out on the 21st January. I made a note of it about five minutes after. I was called to witness by Mr. Cairns, to see him take possession of pit or shaft, sunk by John Robertson and his son, J. Bowman, and G. Bowman, Stillman Downie, and Ward Edgitt; the latter forbid us all from going near the said pit or shaft; he was answered by Mr. Cairns, who said, so long as he or they worked on the surface or soil he would not interfere with them, but now they were working or taking his coal, which he owned by a grant from government; and he said they had better give up working, for he intended to protect that coal. He also asked the said parties if they would take the barring out of the said pit or shaft, and he was answered by John Robertson, that they would let all stand as it then was. Mr. Cairns also said, if he or his men did any damage to land or soil, he would pay all damage; and Mr. Cairns then gave the pit or shaft to me in charge, and to let no person or persons take or interfere with the coal, and to take away the coal they had taken out of said pit or shaft, which I did; and caused to be built a temporary shed over the said shaft, not interfering with any of the bars in said pit or shaft. John Robertson and his son were there all winter on the land, and not interfered with. There were two buildings there at the time, the same as delivered by Duffys. Cairns has erected buildings since, on his own land, and on no part of this. The land adjoining belongs to Mr. Allison, and he gave it over to Cairns. I have been 18 years working in mines. I will be 30 years of age next August. I have worked in many mines. The first, colliery in Lanarkshire eight years—many descriptions of coal in that field, part bituminous. Next in Dunlaggan colliery; next in Hinlot colliery. I have been three years in this country. I have worked cannel coal in Eglinton colliery, in Ayre-shire—a small thin seam overlaid by ironstone. This coal is brighter than any I have ever seen before. I think this is a rich coal. I have a good many specimens. With the exception of this coal, lying nearly perpendicular, I know very little difference by some I have known in the Old Country. Most of strata is parallel with walls; where the seam takes a turn, the strata shews the edge to the seam. This is a fair specimen of most of it. The rest is coarser. You could not get a finer specimen than this. This is another specimen from the mine, which is rather coarser in the grain. This is a piece of fine and coarse together—smuts the hands. I could furnish 10 or 12 chaldrons of this coarser kind. As you descend it has more of an overlay,

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Wherever the vein turns the shale is twisted. The average width is seven or eight feet. The shales lie up and down. If this seam was as near flat as some I have seen in the Old Country, I would not know the difference. In some of the seams in Scotland, I have gone ten yards without finding a cleave, and then had to blow it with powder. I never saw any fossil fish till I came to Albert. I have some specimens. [Produces several specimens.] The fish is generally found on the roof side or overhanging side. Till within three or four months we never worked on the floor or lower side. Our pit No. 1, is through to floor, we found no fishes there; but we found plants: this is one. [Produces great many specimens containing portions of fossil plants.] I took all these from the mine myself. This is a specimen of coke from our coal, used in our blacksmith's shop. I caused the smith to clean out every other particle of coal, and gave him coal to make an axe, and this is the coke made from the coal. He made an axe with it. This specimen is from four miles from mines—fossil plants in it. These are two pieces containing sulphate of iron, out of the roof. A fossil 16 rods from the mine. I was there when mines took fire. The night before it I got hurt—next morning at eight, men were at breakfast. I saw smoke coming up, and I cried out all hands. I covered up pit's mouth, and all escape of air, and I was afraid it would not go out fast enough, and I turned the brook into the shaft till it was out. It took us three days to get water out, and then I went down with D. Robertson. We found that fire had caught on coal. There were five timbers in the one next the coal had the back burnt off. There was a half bushel to a bushel of coke similar to this. There was no hard crust which we had to break up with a pick. No appearance of coal running; it could not run the distances the witnesses said, because the timbers are a foot through. I saw no remains of melting and running. I never said that it was purified by the fire. All I could see was the coke. I saw nothing on the face of the coal to justify the opinion that the coal had melted. I have found the metals which usually accompany coals: they correspond with the metals in one coal field in Scotland, only their lay is different: they are horizontal, and these are vertical. I never received any instructions to prepare fire arms. I saw no disposition to resort to violence. The specimens I have given are good; and I have given specimens of every kind in the mine. I have never found any soft in the mine like these produced by Robertson, or within a mile. I have seen naphtha and petroleum springs in the neighborhood of coal mines in Scotland. I have worked under them. I think Duffy had 270 chaldrons when Cairns got possession, and they hauled them away. I

know where Duffys threw their shales, and we placed our coal on ground covered with shales by Duffys, and no other place. Between 30th December and 4th February we did not occupy so much ground as they did, and what we occupied was a portion of the same; they cut timber there, and we did not cut as much as a broomstick. The first timber we got was off H. Steves' land; and since on our own. The stick spoken of by Ester was lying down, and two of our men asked if they could have it for a fire, and he said yes. I know of no other.

*Cross-examined by Milner.*

I have never seen a coal mine so near a perpendicular, or with coal so bright. I have seen coals as soft. There is main coal generally used for household use in Scotland, and blacksmith's coal as soft, and softer than this—they lie horizontal. At one end it is nine inches, and the other two feet, south west end; the greatest width, about 12.4 inches. I had as wide as 14 feet; length is about 400 feet; the whole working is 450 feet. I once worked in a four feet seam, where it would thin off to six inches, four times in the length of this house; the strata wavered. The nut hill swelling coal: the same coal and the same wavers I spoke of in Halifax; that field had a floor of bituminous shale; it had a calf roof—alum ore. I saw no fossil plants or fishes in that—nearest to this I ever saw; just looks like this, only not so bright; burn the two together, and you could not tell the difference. This coal has layers in it, but nut hill has none. I worked 180 fathoms down, and naphtha springs over-head. I should think 100 feet of 400, the shales are bent; I think more on roof than on floor. The strata is more regular on the floor than on the roof. Strata is more regular on the north east than south west side. I think three or four months since we found fossil plants; we found some fish scales. I will not say this is vegetable: nor will I say it is all fish scales. A few more fossils I have found, besides what in Court. I have not given any attention to looking for plants, till three or four months; for till that time we did not work to floor of seam where the curves occur. I have seen the coal running into these curves. I never have seen a crack filled up with the injected matter. [Is shewn specimens by Robb and Leidy.] I have seen like this. This is not part of either roof or floor; but comes out of one of the horses. The coal is not in the stone, but the stone in the coal. Where the strata are not parallel, they are irregular, and indicated by curved shale; this is from the north east end of seam, about nine feet wide. In Halifax I said I found a piece of mineral charcoal as large as my thumb nail.

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Coal is formed of vegetable matter. I would not believe a geologist if he were to say this were injected and cooled, and that the creeks were filled by subsequent injections. The most of what comes out of mine is like the best and brightest specimens. I can't tell how much of the rough specimens we have taken out; the shales on floor and roof are different. More bitumen in roof than floor shale: the one a fish on it, the other a plant. We use different kinds in blacksmith's shop—Grand Lake, charcoal, and our own. The first three months we used our own; our own does not suit so well as Grand Lake coal: it produces more flame. When vein is small, coal is more compact and hard; when large, looser. I have seen same kind of plants in Scotland, and others at same time. The fern is a common thing, and I have not seen one here. There was no explosion in mine when fire took place. I being manager, had occasion to look particularly at every part of the level where fire had been. The idea of melting never came into my head. I am sure Con never asked me what he should do with the melted coal. This is pretty near pure coke. I never tried to melt it but once. I won't say it will not melt.

*Cross-examined by Kerr.*

When they went into mine, Duffy delivered a piece of coal, and said, I give you up possession of all this mine. I can't remember any thing else; I dare say there was something more. I think Binney was working about 300 feet from slope. I was there when 23 men came. I came to put them out, and I was resolved if they did not go out, I would put them out. I saw no guns that day with Cairns' men; but afterwards, through the winter, I saw some of the men have guns. There were men watching the place—I won't swear they had no guns. We took dirt out of the shaft, and covered road with it about 200 feet. On the 8th January the shaft was sunk. We did take out shale after the 9th January; but we did not put it on the ground where no shale before. Up to 4th February, we raised the shaft ten feet above the surface, and then took the shale to fill up round the shaft to raise the road and remove the hill. Between 1st January and 4th February, we did not take out 25 tons of shale. Where we laid the shale, was where Duffy had his road of shale before. We have dug under ground 450 feet. The posts we put will rot; but the land will not cave in when the timber rots. I have been in workings 300 years old, and not fallen. A part of this has fallen in before the post rotted. Where the road is, a slough took place once, not many feet round.

*Re-examined by Attorney General.*

No land fell in before the 4th February, 1851: this was in road.



The excavation where slough was, was where Duffy worked. There might have been three boxes of shale taken up every day; less danger of soil falling in when vein vertical. Cairns only told Robertson to go away from the mines, and not from land.

*James E. Teschmaker, by Gray.*

I am an Englishman. I have been twenty years in the United States. I have acquired a knowledge of all minerals in the United States; but during the last eight or ten years, I have turned my attention to structure of coal. I undertook, first study of shales, and then to coal itself. I think I can select the structure of coal, and form a pretty good judgment of the subject. I have seen some specimens from the mines of the United States. Coals are formed chiefly of coniferous plants. I have examined many specimens of Albert mines; I have them here. I will take once specimen at once. This specimen is anthracite from Pennsylvania, and has same button-like appearances, as the specimen produced by Brown. These are two more specimens of anthracite, with the same button-like appearance at the ends of the lamina. This is one among many other reasons why I take this to be coal. I never detected those marks before in any other coal, but the anthracite. This is a specimen from Frostbury, Maryland, of bituminous coal, with little concentric rings and cavities, and these are two specimens from Albert mines, with similar concentric rings and cavities. These are two specimens of anthracite, with the cavities, but not the concentric rings. These are supposed to be formed by branches of fir. [Shews some branches of spruce cut off, corresponding in shape with the concentric rings in coal. Produces three specimens from Maryland, with smooth dark parts, without lustre: one of anthracite, and one of Albert mines, with parts the same]. This is a Frostbury specimen, with the bituminous veins distinctly marked, as in the specimen of Albert coal (x w). All these marks clearly indicate, in my opinion, a vegetable structure. The specimen of anthracite contains an impression of a leaf, and this from Albert mines has an impression of a similar leaf: it was sent to me by Dr. Jackson. To me this is a strong mark of its vegetable structure. This large specimen I got from the mines; this from Frostbury; and the three anthracite have polished surfaces. This large specimen has a similar polished appearance, from Albert mines. In the Albert coal, the bituminous action has destroyed nearly all the vegetable structure; but I have not the slightest doubt of its being of vegetable origin. I look upon it as a regular coal formation. This has a number of points agreeing with other coal, and could not be an injected mass from

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below. I should think the fibrous structure the best possible evidence of its being of vegetable origin. I am acquainted with plants in shales. This is a *lepidodendron*, peculiar to the coal formation [produced by Brown]. The finding of that here would be evidence of its being coal: this is a plant; it is new to me, and I am satisfied it is of vegetable structure. This is also vegetable structure: this I have, but no name for it; and they are all peculiar to coal formations. I know nothing of the fishes found in coal formations. I don't see how it is possible this can be asphaltum. I was in the mines, and examined them. I powdered some, and exposed to crucible in lamp: it swelled up, took fire, and made coke of it; about 56 per cent. coke. I have no doubt it is coal. I have about 3000 specimens of coal, which I have collected to compare, to ascertain the internal structure. I found shale not so perfect as coal. When you have the impression in coal, it is very perfect and fine. I had made mineralogy and botany a study in England, and no one who is not a botanist can detect the kind of plants. I am 62 years of age. I find a lamination in the Albert coal. [Looks at largest specimen by Brown.] Here are the laminations: it resembles the Maryland coal. I saw a great deal of bituminous sulphate of iron in the mine on the shale: it is all over the world, every where. There is nothing in the specimens brought by me of conchoidal fracture: it is very perceptible in the Albert coal: it is only an indication of a certain homogeneous character: you have it in coal, in ice, in limestone; it is not uncommon in coal: this is one in anthracite: it requires a certain arrangement of particles.

*Cross-examined by Milner.*

I am in a sugar refinery. I have followed the study as an amateur. I injured my eyes with the microscope. Coals chiefly formed of vegetable substance. I am of opinion that the button-like appearance are formed of layers of pine or fir branches. I know agates have nothing of the kind. I have not seen any plants in the Hillsborough material. The impression of plants is often found when the material is absorbed and gone; I cannot account for this; I suppose asphaltum is of vegetable origin. Asphaltum has conchoidal fracture; but I have never seen it so laminated. I should think the microscope would be a good means of detecting vegetable structure, where not visible to the eye. I have the *lepidodendra* in the coal itself; you never find it far above the coal formation; I have never seen it in the oolite formation; I am sure that it is very rarely found in oolite formation; but it would be characteristic of any formation wherein they are found. If Leibig were to say he had melted the Albert coal, I would not

believe him. I powdered it, and put it in a platina crucible, and put it on a spirit lamp; it swelled up and took fire, and coked. I have tried over and over again to melt it in vain. The conchoidal fracture is characteristic of resinous bodies. The specimens I have produced are not rare. I have asphaltum in my cabinet; but I have never examined any mines of asphaltum. I have not remarked any laminations of asphaltum; it is brilliant in appearance and light in gravity. I don't know of any coals as light; I have never seen any coals as light as this; the nearest to this is the Maryland specimen; I see no laminations in this. [The specimen produced by Dr. Leidy.] When this question came up, I gave my asphaltum away; I don't know any coals as light as this, though I have not ascertained the specific gravity of it. I knew the late Dr. Taylor in England 25 years ago. If I saw it was fusible, I should not think it was coal. If I had dissolved it, I would conclude it was not coal. If after it was melted and broken up, it presented the same bright appearance on a fracture, it would be a further evidence of its not being coal. No coal could ever do that. My attention has been given rather to structure, than the points inquired into now. I am satisfied anthracite would not fuse or dissolve. I was in a coal mine in England thirty years ago. I was in one at Rhode Island two years ago, and in this one in Hillsborough. I don't think one of my specimens can be called rare. I should think asphaltum might be produced by the resinous substances of the fir tribe. I don't think the button-like appearance would result from crystallization. I never made any analysis of coals. I have not tried any coals to see whether they are fusible. I think the button-like appearances are not discoidal. In the anthracite the impression of the vein is there; but not in the other: the whole of the vegetable texture is gone in both. I never heard of asphaltum with vegetable impressions. There are only a particular class of plants found in coal measures, and similar plants may be where there is no coal.

*Re-examined by Gray.*

There are many plants in coal where you can't see the veins. I understand melting when it will run. I don't call softening, melting. If I had found it melt, I would not have looked for its vegetable structure, as coal. There is great difficulty in grinding coal for microscope. Might grind twenty pieces and not get one. We use about 3000 tons annually in our sugar refinery. Adjourned.

*Owen And*

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WEDNESDAY, 28th, 9 o'clock.

*Owen Anderson.*

I live at Hopewell corner, going on seven years. I did not know Mr. Cairns till last Wednesday. I am a blacksmith: have been so twenty years. I have been at the mines twice, while in Duffys possession. I have seen the coal raised there. I carry on blacksmith's work. I have used some of this coal at my work. I used a little in the house. I think the last winter Duffys was there, I got coal. It answered a good purpose. I used it for all manner of work. Making axes, ironing ploughs, making horse shoes—all kinds of country work. I used the coal pretty much the whole winter. I found it answered my purpose well. I can't tell how many chaldrons I used. I brought one chaldron, and Ephraim Pierce brought in another load, and Martin Downie a load. I considered it a coal, and the very best quality of coal, and I consider it so yet. I have no reason to consider it otherwise. I have not used it since, for the price has risen since it came into Cairns' possession. It is something like double the price of other coal. It is about ten or twelve months since I heard doubts as to its being coal. I have tried some experiments since. I got a large lump of Joggins coal, broke it up, and took the best looking parts out, and put them in a wrought iron crucible; it swelled, and became coke. I took it out and laid it in the forge, and then filled it in same way with the Hillsborough coal, and heated it: did not swell up as much as the Joggins coal. After blaze and smoke gone, I took it out and laid it beside the other, and when cooled no person could tell which was which; I could not unless I had known. I shewed the coke to several persons, and they could not tell them apart; it did not run out of the crucible—I had to dig it out; it stuck to the bottom. I heated the crucible red hot. After a certain degree of heat, I took the crucible out and set it down: this was done last Saturday of my own notion; and I then called in Mr. Wood to see it. I have worked with Pembroke coal. I think that is nearest to Hillsborough of any I have seen in the working. It is a very clear coal. Under heat it is very near to this, and behaves pretty much like this. I have tried to melt the Albert coal in a crucible, and in a candle, and did not succeed. I took a piece of Hillsborough coal, a piece of asphaltum I got at M'Almon's, and a piece of wax, a mixture. I heated a piece of iron, and laid the three on together. The asphaltum and the other almost immediately melted, and the Hillsborough remained till the iron was black, and it was only crisped and charred, but not over the thickness of a piece of paper. With this coal the fire required cleaning oftener, which shews it had more cinder than some others—Pictou and Sydney.

The cinder of other coal is hard as flint, this is softer and more brittle. I first saw asphaltum last summer—called Trinidad. A gentleman at M'Almon's gave me the asphaltum. I tried it in coal tar in the crucible; I filled it one third with coal, and put in tar to nearly cover it. I boiled it; the coal tar dried away, and burned up, but the coal remained. I had broken up the coal to small pieces; I heated it red hot. The pieces were a little soft outside, but on breaking it open I found it bright and hard as before. The person from whom I received the asphaltum is called Barker.

*Cross-examined by Kerr.*

I am not a geologist or chemist. If I went to mines and got it myself, and melted it, I would believe it to be asphaltum. I should say this [Dr. Leidy's specimen] is a fair specimen of general mass; to be honest, I could not believe any person, who would say he had fused or dissolved it. I never found any thing like what I call melting. Take a piece of tallow or resin, and they will melt. I can take the Joggins coal and put it in a crucible, and in a certain state of heat I could pour it out. The piece I tried was a piece of the general mass. I got some that I tried in the blacksmith's shop in this neighborhood. I did not see it brought from the mines. Some of defendant's witnesses stop at M'Almon's. The first experiments I tried were before I ever saw anything of defendant or his witnesses. I have never seen an asphaltum mine. The piece I got as asphaltum, I got from another. I have seen gentlemen exhibiting pieces called asphaltum about the roads here. I melted it in an iron crucible. It would hold a pint: it was about three eighths thick—something shape of tumbler. My first experiment was two or three weeks ago, to satisfy my own mind. I can't tell you who gave me the piece I tried three weeks ago, or where I got it. I had no idea of coming to this Court as witness, when I tried the first experiment. I had on a fire of sea coal, and I burned the article in a crucible till it blazed and became a coke. I did not then try whether it would run out of the crucible. I took it out with a piece of iron when it began to get cool: there were small portions sticking to the crucible. Mr. Wood was present at my last experiment; he lives near my house. The piece I tried my experiment with last Saturday, I got at M'Almon's store. I should say same material as this—[Dr. Leidy's piece.] I broke it, and put it into crucible, and set it on the fire, and when well burning I stopped blowing, and left it in the fire till blaze and smoke gone. I then took it out, cooled, and removed it, and got some bits of Joggins coal. I did not try to pour it. I heard persons say it would foam over and run out. I tried and found it would not do so. I will swear it will

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not melt unless something put with it. I tried it in coal tar the same day; it all blazed up in the crucible, and left coke. Mr. Moore was present when I got the asphaltum at M'Almon's, Mr. Barker, and that gentleman from the north. I put it in crucible, and let it burn to see if any coke left or not. I think I let it burn out, but I can't say. I did not blow it out. I found a small crust, thin as brown paper, but harder. For blacksmiths' work (small work) I would take it in preference to any I have seen used. For larger work, it does better when it is coked. It cost me 15s. at mines, and 10s. per chaldron for hauling. I did not apply for it after that winter from reports of increase of price. I have since been out of coal, and did not go for any. The road is very rough and long in summer, and I heard price had raised after Cairns got the mines. All the work done in the shop was done by myself. When it was burning in cooking stove I did not notice whether it melted. I believe it did not. What I call melting is to run over the bottom of the stove. I did not rake out the ashes to see if it had melted. For a short time after I got it I had some charcoal, but it did not last long. I made axes, horse shoes, ox shoes, and found it did well. I had conversation with Samuel Gross, and told him it was no good, in answer to a question he put to me. I don't recollect, I told Samuel Gross I would be glad when the cursed stuff was gone. He was at the mines when I got the coal. My opinion was not what I said to Mr. Gross. Sometimes, in order to save controversy I will say what I do not mean. What I said to him was in his own shop. When I had teams at mines, Gross was there after sleds loaded. He said I would not have those coal to haul them home; I made him no answer whatever. Last summer I went to make him a lot of carriage springs, and in answer to what he said, I said they were no good. I always knew that he was opposed to the coal, and I did not wish to raise a controversy with him, as I was working for him, and had not been an hour there. I told Cutten last Saturday, that it was excellent for laying axes after it was coked. I told him I could not use it for laying axes, until it was coked.

*Re-examined by Attorney General.*

I told Cutten I could make from a horse nail to a ship's anchor with it. I always coked other sea coal for laying axes, but not for ordinary purposes. From the appearance of the specimens I used, I have no doubt they came from the Albert mines.

*Thomas C. Lee.*

I am Receiver General of the Province. I reside in Fredericton. I have held office since 1836. I receive all monies for casual reve-

nuc. I have records with me. This is original record of all receipts and payments by me as Receiver General. I have a book where I enter copies of receipts.

*Cross-examined by Kerr.*

I have only a copy of receipt book besides this, and entry in margin of amount so receipted. I give monthly access to the auditor. I don't think an error has been found in one instance. I have not the receipt book.

*Attorney General* offers to shew that at times mentioned in lease to Duffys for payment of rent, the rents were paid.

*Kerr* objects to evidence of any payments after date of the assignment, and also to evidence of any acts after 4th February.

Judge rejects the evidence.

*Attorney General* offers evidence to shew no payment of rent by one Foster Bryant, on any mining lease in this Province, up to the 4th February, 1851.

*Kerr* objects, that Foster Bryant no connexion as appears in this case, and such evidence irrelevant.

*Attorney General* says—It may be relevant: don't know what evidence may be given to rebut; and this is to answer it.

Judge sustains the objection, that no evidence can be given of non-payments by Bryant at this stage.

*Professor Benjamin Silliman.*

I am a chemist: have devoted my attention especially to chemical mineralogy and geology. In winter I am in the medical department of the university of Louisville; in summer at Yale College, in technical chemistry, and am one of the editors of the American Journal of Science. Since 1837 I have been entirely devoted to them. I have been in the habit of examining coals and coal fields, and have studied their geology. A fair proportion of my engagements have been of that nature. The largest coal field in the world, is in the United States. Of the Apalachian coal field my own observations extended over thirty miles long, and five to six wide; and I have observed other coal fields, from the summit of Alleghanies to Ohio river. It is impossible to arrive at knowledge of coal fields without geological observation. My attention has been more turned to chemical properties of coal, than geology. I have turned my attention to chemical properties of Albert coal. I have specimens here: these I took yesterday from the mines. Coal is remarkable for its structure, as distinguished from other carbonaceous minerals, in which class I rank asphaltum.

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If we take cannel coal, it has three modes of structure : a plane in one direction, and another at right angles to that, and a third at right angles to both ; this results in a cubical structure. We have a plane here ; I have cleaved this from the other. This mode prevails in a remarkable degree in the Albert coal. Here is another plane at right angles. The cannel coal has a third plane ; but in the Albert coal this is wanting ; and it breaks up into what is called splint coal. In a mineralogical point of view, there is no other point in which it could resemble coal. It is brought into relation of highest qualities of anthracite coal by its opacity, its brilliancy, and blackness of its powder. Hardness is another character of coal ; and the hardness of this is like the softer kind of cannel ; but it is harder than asphaltum. This is Cuban asphaltum, and this, of Hillsborough coal ; and by drawing a knife over it, the respective hardness will appear : these are points of resemblance, looking at it as a mineral. Another point is, the specific gravity : this is less than many other coals. The mode of structure I have pointed out, I have never seen in any asphaltum. The density of this coal is less than most coals, though there are coals less than this ; this ranges from 1110 to 1130 of gravity ; several pieces from this vein varied in specific gravity. I have obtained 1.129, and others. I had omitted to say that this coal is eminently electric, which is scarcely found in any other coal. I found electricity in a piece of coal from Kentucky. Since my attention was called to this point, I have not tried many specimens. The streak of the Albert coal is black, and asphaltum brown.

POINTS IN WHICH IT DIFFERS FROM ASPHALTUM MINERALOGICALLY.

In the asphaltum, peculiar mode of fracture—a conchoidal fracture on both sides where I struck it. This fracture more conspicuous in resinous substances. We do not find the conchoidal fracture of Albert coal so remarkable as some specimens of anthracite, and some of the cannel coals too. The other most remarkable difference : there are no lines of cleavage in the asphaltum of Cuba, while they exist in this. Bitumen is proper name. I have never been able in looking over large masses of asphaltum, to see any lines of cleavage. The pieces of asphaltum look like large black rocks. It is brought by ships in ballast to New Haven, for paying ships. We had at New Haven a large quantity of Trinidad asphaltum ; it had no mode of cleavage or structure, like this. Asphaltum is recognized at once by its very peculiar odour ; when bruised it smells more. [Bruises it in a mortar.] The Egyptian asphaltum is more offensive than this. [Powdered and smells strong.] This is Albert material powdered, very black, and



has a bituminous odour, like all bituminous coals. Asphaltum fuses at 212 to 220 soft. I don't mean a fluid. At 250 it will be quite a fluid. At 212 about one and a half per cent. of water is expelled from Albert coal. I have kept it in a chemical stove at 212 for many hours, without its losing any thing but water. The brown streak of asphaltum, its ready fusibility, its lighter density, distinguish it from Hillsborough coal. These two species of coal and asphaltum approach each other very nearly. All of the asphaltum are not electric. The Albert coal is more electric than the Cuban asphaltum, and therefore I do not lay much stress on the electrical character, as determining the class. The Trinidad is a beautiful instance of the formation of asphaltum from naphtha. In Trinidad rocks with trees encrusted at outside it is hard, and at centre is boiling. Where the Trinidad asphaltum is, is called a pitch lake. All coals are infusible, or if they appear to fuse it is only in part. Difference between anthracite and bitumen, and fusible coals. There are certain varieties in England which are called fusible, and will become soft; and some portion, if taken in tongs, will leave impression. The Ohio coal at Pittsburgh is a fusible caking coal. The Albert coal is more easily softened, but by the same mode. There is no fusibility or softening in either case, until decomposition takes place by gas coming off; but asphaltum melts at 212, while decomposition does not take place under 600. The giving out of white vapour is the first evidence of decomposition.

#### GEOLOGICAL EVIDENCE.

Coal field is a term which associates certain rocks, shales, fire clays, bituminous shales, organic remains, fossils: these alternate with each other, but workable seams may be found without them. The coal is between shale, and between and below conglomerate, grits and sand stone, red and gray, and belts of nodular iron ore. These bands of iron are found in no other connexion. As to coal plants, I have examined mines without them. At Pittsburg I found no plants in ten feet vein, and yet it is coal. The mode of deposition was horizontal, but now we very seldom find them. In England the normal coal basin is a basin, and grows deeper in the middle. I have never been in a mine strictly horizontal; in Frostburg sometimes nearly vertical; at other times vary. In every coal basin I have examined, the walls are highly inclined. The coal deposit of Pennsylvania lies in longitudinal triangles, and in some cases it inclines over and is crushed, and is more than vertical, and when struck with a pick it crumbles. I tried this with a pick; it crumbles but not to the same degree. I have been occupied in examining all the positions I could, and have

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observed facts to satisfy me that it is a coal field: there are sand stones, shale and conglomerate. Yesterday in a cross cut in mine, I found a bed of about five feet in thickness, which appears excellent clay. In a geological sense, fire clay has *stigmaria* in it, but this has not; but I consider this to have all the properties of fire clay. I have examined shales in this mine, which in my opinion stand as an equivalent of fire clay. An altered fire clay is a silicate of alumina—one portion soluble and one not. [Two specimens.] The coal plants are distinctive at Bennett's ship yard. This is a calamite; is a coal fossil: this would not be so convincing unless supported by concurrence of other coal plants—*sigillaria* and *lepidodendra* at mines. *Stigmaria* I found at Bennett's also; upon the *stigmaria* are dots and points, and I am satisfied this specimen has all the distinctive marks of the *stigmaria*. These are all found in sand stone, and besides these are others I do not know, broad leaves and fluted: these are all in the same bed; these all indicate a coal formation. This is in same field as the mine. We have geological evidence that this is the case. The only thing wanting is a survey of a cross section. I have some of bent shale. I found fossil fishes abundant, *palioniscus*, and *cotoptrous gracilis*. The *palioniscus* not peculiar to coal formation, but connected with other fossils. It is of value. There are teeth and spines found here which belong to coal formation only. There are remarkable fossil trees here; the rind or bark converted into a substance closely resembling anthracite—at North Cape and Bennett's; and these conglomerates are inseparably connected with the mines. The conglomerates of Edgitt's cape are older than North and Bennett's cape, for these overlie them. It is observable that cause of disturbance at time has acted laterally. [Shews by pressing together a book.] These shales I took yesterday from mine; one piece has a hook, which must have been turned suddenly; and away from the turned part the shales were parallel. This is a piece of folded shale. The bended shales are most argillaceous, and they contain, insoluble 58 per cent.; soluble 26; lost by heat 15½. Had it not been for the twisted edges the shales would have been parallel. Ordinary shales lie flat on coal, but here shales are excessively distorted. I see no evidence of an anticlinal axis. From all my observations, I believe the strata in the main have the same mode of dip; they vary in the angle, but the dip is the same way. Near Frederick's brook, I saw the recurrence of the same stratified beds, which are found in opposite directions. This I consider a conclusive proof that this is not an anticlinal axis. I caused a plumb line to be held, and have dropped stones, and in sixteen to seventeen feet they always

struck the floor, proving generally the inclination is the same. I saw nothing like a widening out: at 150 feet deep we ought to find a great difference in an anticlinal axis, but this does not shew such a difference. I would not call it anticlinal axis although it varied in width. The law of the deposits of South France is irregularity, and not regularity. The coal beds in Massachusetts are excessively distorted. I have found here nodular iron ore, on both sides of the vein. This is a specimen of kidney ore and iron pyrites, and are indications of coal. There is no coal without sulphur, and sulphur is here. I think I have enumerated all the geological evidences in coal. The occurrence of a horse is a very common thing. One reason why I thought the substance not injected is, bits of shale are among the coal, shewing it was in an infusible condition. The force of injection would not have removed such large masses. It is not fair to suppose that whole body of mine is like these beautiful specimens. Without knowing where this rough piece came from, I could not say it was from the Albert mine, but this beautiful piece I should know at once. This is exactly such a bit as you could get out of an anthracite mine. [Largest piece of Brown's.] I should be surprised to see such from an asphaltum mine. There is more diversity in the mine than I had supposed from the specimens I have seen. The resemblance to ordinary coal stronger than I thought. I have seen other evidences. This is a portion of an impression: cylinder shape, wide at bottom, and narrow at top. Had I seen it any where else, I would have supposed it had been a tree. A peeled tree like a mast. Had the rind been impressed, there would have been no doubt. There were delicate, longitudinal, and lines parallel from bottom to top, which indicated the existence of the tree.

#### CHEMICAL EVIDENCE.

After much study and thought, I have come to the conclusion that no substance is asphaltum which will not fuse without decomposition. No asphaltum that I have seen refuses to melt before decomposition takes place. I think this is a distinction which I can stand by, and an irrefragable position. When placed in a flask like this, when decomposition commences a white cloud is visible, and it is gas and will burn. We know substances in three conditions, solid, fluid, and gas, and many solid pass to gas without undergoing intermediate fluid state. This passes to gas without being in fluid state. A more numerous class pass from solid to fluid before they turn to gas. Asphaltum will go to fluid and back again any number of times, so that it don't take fire, which could not be done with coal. [Attorney General claims

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as matter of right to make experiments by spirit lamp, in fusing the material and for other purposes. Professor Silliman lights a lamp for the purpose. Judge refuses to allow experiments by fire.] The most uninformed person may try in flame of candle. A piece of asphaltum will melt and run down like sealing wax—the Hillsborough coal will not. Asphaltum if powdered and put on white paper, and held over a candle, so as not to burn the paper, will melt and take impression of a seal: this is a specimen which I sealed; but with this article it is not so. On the contrary, if Hillsborough coal held in this pewter spoon, the spoon will melt and run down before the coal. I have put Albert coal under melted lead, and it did not rise to the top of the lead, but remained beneath and softened. Cuban asphaltum below lead will melt and rise to the top. If you heat lead to 700, the coal will turn to gas. I have attempted to fuse Hillsborough coal in naphtha, tar, oil, and other menstrua, and the article remained undissolved. I tried to decompose in this glass, and failed: it gave off a copious effusion of gas, and here we have a fine powder and a portion of coal tar. In this case a destructive distillation takes place, and the matter distilled falls back again, and a portion of coal is placed in a menstruum of coal tar, created by itself, and which in turn operates on the residuum and assists in its solution; it is a pyrogenic product. Atmospheric air was excluded, and the temperature was above 600; the bottom of the glass was softened, and I think the heat must have been at 900. I should conceive that not less than 900 degrees of heat has been applied to that Florence flask (Wetherell's). I think the Hillsborough coal does not give off gas under 500. I also tried a similar experiment in a smaller quantity with Drs. Deck and Hays: this is the result—the part next the glass is smooth, the top at the centre retains the original appearance of the fractured coal. Dr. Wetherell gave me a piece of his melted material, and I with Drs. Hays and Deck dissolved it completely in turpentine—not more than five per cent. of residue. We could re-fuse it, and cast it anew. We endeavoured to repeat Dr. Wetherell's experiment on our own, and we could not do it. We dissolved a portion only. This is a peculiar experiment which should be well and carefully observed: it is an altered pyrogen. We came to the conclusion that we could not make any thing of the kind of Dr. Wetherell's. We worked two days and two evenings, until we broke up all the vessels we had. I should decline drawing any inference. Dr. Wetherell is a person in whom I have every confidence. I decline stating any conclusion. We got a piece from Court. We put a weighed quantity in this retort, and after heating it, we found it lost 12 per cent. This proves it is not asphaltum.

I have tried to fuse it in a candle, &c., but have never succeeded in making it softer than ordinary dough. You can do that with some of the Newcastle coal, but not with equal facility. I have tried it in New York with Dr's. Deck and Torrey, and in my own laboratory in New Haven and Louisville, and here with Dr's. Hays and Deck, to dissolve it in various menstrua. I have found best solvent to be spirits of turpentine, and highest average of solubility eight to ten per cent. We pulverized it very fine and put it in flask, and repeated the operation until we found the turpentine not colored so long as warm in turpentine above boiling point; but when cooled, granular as before. When substance was weighed, we ascertained what it had lost. The only mode in which any relative result can be obtained, is by the filter, and not by evaporation. I never succeeded in getting more than twelve per cent. by the benzyole. Under alcohol, Hillsborough yielded half per cent.; to ether 3 27.100 per cent. chapapote; lost in ether 22 79.100; in alcohol only about half per cent. So neither alcohol or ether is proper menstrua for these substances. I tried it in sulphuric acid, and found it produced humous. Sulphuric acid boils at about 600. I have found no menstruum in which this could be dissolved; great danger of deception by solution in turpentine—it will give a dark color to it. It is a true solution of a certain portion of bituminous matter in coal. I have tried it in coal tar, grease, resin, oil. To all it imparts the same coloring; it does not dissolve. In this crucible are two parts of gas tar, and one part of coal tar; it was heated, but could not be turned out of crucible; this has three fourths its weight of coal tar, and was heated one and a half hours, at a heat equal to boiling lead, 600. This small crucible contains equal parts of coal tar and coal, and in no case could they be poured out: the coal was not fused, but was in suspension, and could be felt with a spatula. Coal tar when boiled to half its bulk becomes itself a pitch, and is sold as coal tar pitch. If a man had said he had graved his boat, from coal dissolved in coal tar, I would say he had graved his boat in coal tar. I have coked some of it, and it increases in bulk from thirty to fifty per cent. This was produced by me: it is light and porous, but not so light as some other coals. I have thought the coke and coal stood as sixty to forty. I have obtained it as high as sixty two, and as low as fifty eight. I have made an average of all the kinds I could find, and mixed them; and deducting one and a half per cent. water, this yields fifty five per cent. gas. This coke is from Ice Hall coal, and yields seventy three of gas, and swells to double the size. This coal swells more than the Albert. This coke is from Pictou, which yields fifty per cent. of gas.

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This is Kentucky coal (a slate cannel), and it yields sixty seven per cent. of gas, and does not swell at all under heat. This is from Ramsay's Main, Newcastle coke, double the volume of coal from which produced, and gave seventy one gas. This is from Frostburg: this does not give over forty per cent. gas, and coke swells three to five times its original bulk. I mention these facts to shew there is no relation between the bulk of cokes and the quantity of gas produced. This coke was taken from a gas retort, and is a conductor of electricity, and is used in galvanic batteries: this is hard as steel. The coal from the Ramsay Main yields to turpentine a slight coloration. The Ice Hall, and cannel coal from Scotland, do the same. As the result of all, I come to the conclusion it is impossible to fuse it without chemical decomposition. An organic analysis is interesting. Coking is a rude analysis into volatile and solid. I understand by term "mines," a place where a valuable deposit of mineral is found. I think it would have been as proper to say there were valuable mines of copper on Lake Superior before Jackson discovered it, as afterwards. It is proper to say a country is rich in mines, before mines opened. There is a technical sense in which it is used. A mine is not a quarry. Technically, a mine would mean an opening in a mineral deposit.

*Cross-examined by Milner.*

The order of my evidence, geological, mineralogical and chemical. I form my opinion on all as concurrent evidences. If the geological evidence fell, the character of the evidence would remain. If the geological formations were different, I should call it a coal mine out of place; but to me it is impossible to look upon it as a coal bed out of place. I may be mistaken. I never desire to take the position that I may not be mistaken. If my geological premises are incorrect, my geological conclusion will be incorrect also. I have been all about the vicinity of the mines and noticed the formations: the general dip is southerly, as crow flies. I should think it is three miles from Edgitt's to the mine. I have not been able to find where the shales join the conglomerates. On the Demoiselle creek road, I saw best appearances of union of shales and conglomerate: that is perhaps one and a half miles from mine. The dip at north west of mine is at a high angle. I am stating my general conclusions. The dip becomes more and more, till it comes to the mine. I found fossil plants in mine and at cape. I discovered calamites on sand stone west of mine. It appears to me shales are beneath the conglomerates. Where I found the shales was beneath the red sand stone. There are no plants from the mine which I have found myself, which would

justify the opinion of its being a coal measure. I am not aware that *stigmaria* is ever found in connexion with any other formation than coal. Calamites, *liquillarin*, *lepidodendron*, and *stigmaria* associated, are evidence of a coal measure, and nothing else. I don't know *stigmaria* are found in any other formation than coal. *Sigillaria* is evidence of the highest probability. I am satisfied it was a *stigmaria* I found at Bennett's. The Hillsborough mine forms one of the exceptions to the general rule. I am of opinion the force acted upward and laterally. I have seen instances where no fire clay at the bottom. By a coal bed we mean the alternating strata. Frostburg has no *stigmaria*, and Richmond none. There is no fire clay in the mine in patches. By fire clay we understand a friable material, which by application of water returns to a pasty condition. Shale is a general term which we apply to all laminar rocks. The theory is the contraction of earth's surface; the crust had been too large for the earth, and it had cracked, which formed mountains by crooking of surface. It is a dynamic action. The same cause which erected the shales in Connecticut, erected these. The shales are more or less plastic in the mine. The turned ends of the shale is not in consequence of the substance being injected. This is an injected, or included mass—[specimen of shale]. Upon looking at it, I would say it was an injected mass; but I can't hang an opinion on it. All dips in Pennsylvania are trough like. The horse was near to one of the walls, but is now removed. A miner went 120 feet from me, before I lost sight of him. There was a little deflection to the left; I observed the same at the other end. Professor Taylor's work is very useful; his opinion on this question, a matter of consequence. When I first heard Taylor's statement, I received it; but when I came to examine the mine and material myself, I rejected it. I never saw a coal identical with this; nor did I ever see another coal identical to Kentucky. I know of no other coal which presents the same group of circumstances. The average dip of this vein is about an average of seventy degrees. I have never been in a mine with a dip like this; it conforms entirely to a distinct bed. I looked for a specimen like that, but could not find it. The disturbed condition of the floor is different from ordinary coal beds. I think I found fish scales, top and bottom. This is first mine I ever visited where fishes were found. I think fishes afford evidence of coal; had they been of another family, it might have been different: I know as matter of report, that the *palioniscus* was found in silurian shales of New York, by Mr. Hall. I know from Agassiz and Lyell's reports, that the *palioniscus* is found in the old red sand stone. By saying they are characteristic of coal measures, I do not

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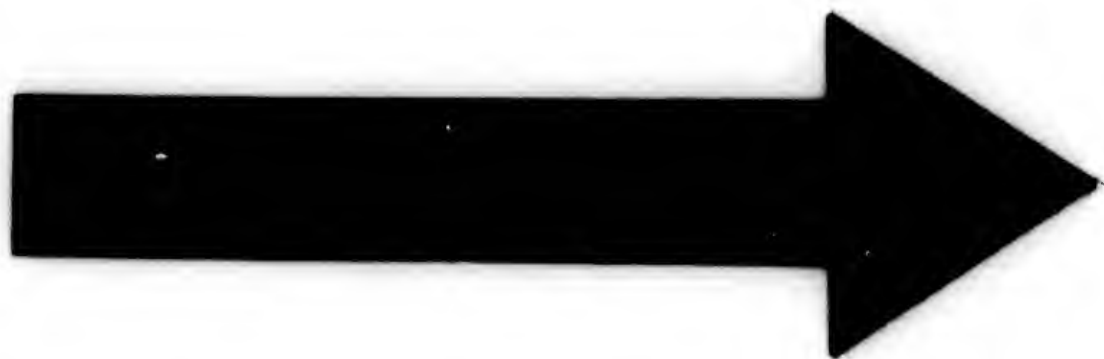
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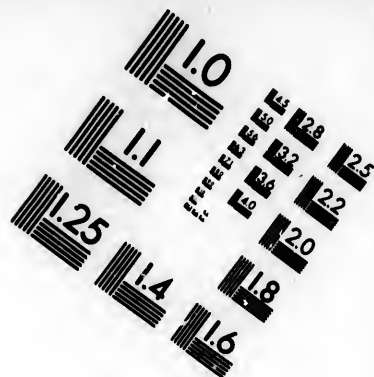
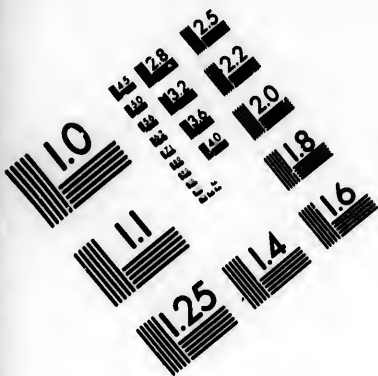
mean to say they are found no where else ; and if any person were to say they were found in no other formations, it would not be correct.

*Cross-examined by Kerr.*

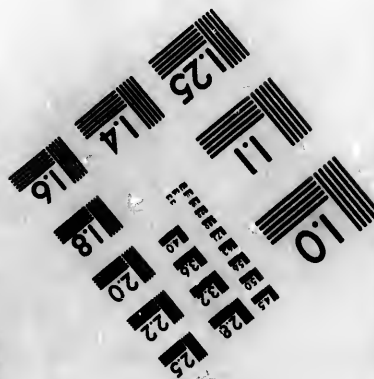
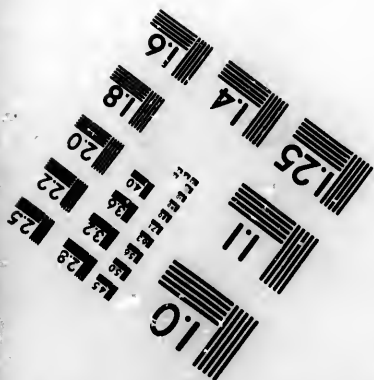
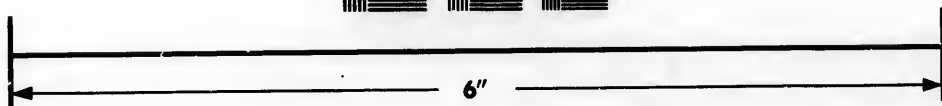
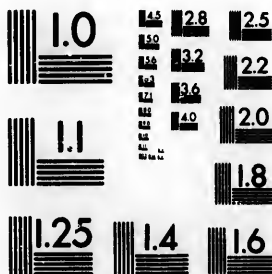
I know more of coals than of asphaltum. Many years since, I examined Trinidad asphaltum. All the asphaltum differ in appearance ; they do not differ in appearance as much as coal. I should say the two substances now shewn me were identical. The asphaltum differ very much in appearances. This is a very fair specimen of the general mass. [Leidy's piece.] These are portions on which I experimented, received from Dr. Torrey. In this mine different specimens may be found which slightly vary in their solubility. The absence of lamination is one of the characteristics of asphaltum. You will observe a cleavage in this piece. [Leidy's.] I gave no evidence of stratification. I see no stratification—it is obliterated. I make a distinction between stratification and lamination. Asphaltum presents a conchoidal fracture : it is characteristic of all homogeneous substances. Asphaltum is light. The specific gravity of this piece resembles asphaltum. It differs slightly in weight from different parts of the mine. The Cuban asphaltum is lighter than the Hillsborough, or about the same as the lighter portions I found. Some asphaltum contains a great deal of foreign matter. Asphaltum results from the oxydation of the naphtha : it is obvious from the Trinidad, that it results from exudation, and is not injected. The Cuban is an injected mass, according to Taylor, and is open to day. Asphaltum never has vegetable structure. [Looks at Leidy's piece.] This does not present any vegetable structure to the naked eye. I know Dr. Leidy. I only know two who are his equals in microscopic observations. I think he stood in the first rank. If he said he found no appearance of vegetable structure, it would be no more evidence of asphaltum than in anthracite. The only method of discovering it in anthracite, is to reduce it to ashes and examine it. You may look at a thousand specimens of anthracite and not discover it. I think the Rhode Island coal gives no evidence of vegetable structure. I don't know that it was examined by a microscope. The absence of vegetable structure would make them both alike in that respect. Those gentlemen from Philadelphia to be implicitly relied on. Asphaltums certainly are soluble. One distinctive feature of asphaltum is that it is fusible without decomposition. Where it decomposes before fusion it cannot be asphaltum. This is a fact in chemistry, and not a principle. Amber may fuse ; it is a fossil resin ; it is not particularly fusible. It may be roasted and made soft, and then it is soluble. The ambers as a family of resins are fusible. Amber is a combustible body, and I think the ambers







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that fuse are fictitious. The amber I dug up in Sicily is not fusible. Fusibility is a physical character and not a mineral character. That is a piece of Senegal copal dug up on the coast of Africa, and some call it amber; I have seen pieces called amber, which are fusible. When amber begins to smoke it gives off gas accompanied with succinic acid. There is a similarity between the two. Sealing wax is soluble. I succeeded in fusing and dissolving the mass I got from Dr. Wetherell; but I said it generated coal tar, and was dissolved in its own product. I have watched most carefully the mode by which heat acts on asphaltum. The Trinidad asphaltum is more like this specimen of Cuban asphaltum taken from the sea. This is as heavy as some coal. No man could take it for anthracite or cannel coal. It appears to me a different quality of the same material. As a mineralogist, I see a decided difference in mode of fracture of Hillsborough and Cuban. My impression is, that Egyptian asphaltum fuses at lower temperature. I don't think there is a difference of 10 degrees. I have seen Trinidad very brilliant, and conchoidal fracture. If I found it perfectly fusible and soluble I would rank it as an asphaltum. Colors by transmitted light are very different than by reflected light. Brown coal of Germany is amorphous, and transmits a brown light. I never put it under microscope. It is full of vegetable tissues; it is a sort of lignite. In mineralogy we call a substance amorphous which is not crystallized. I know of no coal without vegetable remains. I should feel greater confidence when the microscopic observations are confirmed by other microscopists. Our means of testing were sufficient for the purpose, but not as good as we might have had. There is asphaltum of Peru of very solid and compact character. Asphaltum is composed of asphalten and petroline. I consider the application of heat would not have made it harder in the vein without the effect of the atmosphere. Dr. Wetherell's melted piece looks now like a piece of resin or pitch. The lustrous appearance is not an argument in favor of its being asphaltum. I never saw a piece of coal melted as I say. This has some aspect of the solution I made of Albert coal. [Wetherell's bottles.] I would believe Dr. Wetherell to be an expert witness, and a man of veracity. I don't know of any coals that would produce the same effect as produced by Dr. Wetherell in solution. I think I know a cannel coal from Scotland soluble to the extent of five per cent. I have tried many times to solve coals. You might examine a great many varieties of coal and not find any appearance of vegetable structure. The Hillsborough coal has a bituminous odour, and smells like a Scotch cannel coal. I am director of gas company in New Haven. Coals are called bituminous

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because they yield bitumen by transformation. Bitumen is a rich hydrocarbon. Bitumen coal does not distil coal tar under 900. I have seen iron welded with Hillsborough coal, and I have used it in grate. The gas of Boghead is as dense as this. This is Boghead specimen. Always a different appearance in coal from same vein. There is a great variety of coals—scarcely any two precisely alike. The difference between the Hillsborough and asphaltum is so great, that it takes it out of the class of asphaltum. Coals all agree in their essential insolubility. All coals leave coke, and do not fuse without decomposition. If I found it soluble entirely in any menstrua, I would not consider it coal. I have examined a great many specimens of asphaltum which are not electrical. I know two electric coals, Kentucky cannel and another. I define a mine to be, technically, an excavation in the earth from which minerals are taken. I know Dr. Jackson. He contributes to the Journal of Science. He is Vice President of Boston Society of Natural History. I presume the article in p. 292 in this book, was written by my brother-in-law—Dana.

*Re-examined.*

I am sure Professor Taylor first described the Cuban asphaltum as coal. I think if he were here now, he would carefully reconsider the case. When he saw it, it was only 50 feet deep, now 150; he says no plants present, but there are now; and if he had known it, he would have reconsidered or altered his opinion. If this piece of shale was from the horse, I should say the substance was included; but if in the walls, I should say it had been squeezed in. All the inequalities are filled in with coal. The piece produced by Dr. Wetherell has changed its nature; it is lighter, soluble and fusible. Had asphaltum been passed through ether, turpentine and naphtha, nothing would have remained. All mines furnish specimens which vary a little in specific gravity. I think the streak of powder a good method of detecting color. In Mantel, Lyell, and Taylor, I think it is said that all traces of vegetable structure are destroyed in some coal.

Adjourned.

**THURSDAY MORNING, 29th, 9 o'clock.**

*Doctor Percival.*

Deposition of, taken before Thomas S. Sayre, 22d August, 1851, on part of defendant, pursuant to an order. (*Vide Deposition B. in Appendix.*)

*Doctor Augustus A. Hayes, by Johnson.*

My occupation is that of practical chemist. Employed in special geology and mineralogy. I have been 28 years in all, engaged in study and practice. I have been sub-Professor in a literary institution in New Hampshire. I hold office of assayer in State of Massachusetts. I mean by special geology the study of internal structure of mines, and this includes all minerals. This is a shale. This is a piece of fire clay (shining); the shale is rough, and applied to teeth; one is hard, and the other soft; differs to the eye, and still more chemically. This is iron stone of Albert mine. By arranging minerals I shall exclude surrounding rocks. The shales are in thin lamina, not thicker than paper, and in horizontal directions; mica in them; in the fire clay a slight lamination. The clay contains a variety of carbonate of lime. [Witness constructs a representation of mine on the floor.] The fire clay is finely divided, and fine and soft, and answers for marking; in a more plastic state it would form vessels. The shale in fracture, and color, and lustre, is distinguished from the clay iron stone; the shales have largely disseminated through them fine particles of coal, and when carefully taken apart these coals become visible to the naked eye. Then we see fossilized remains of fishes abundantly distributed through the mass, indicating that this had once been a silt moved by water, and on which water has flowed, and fishes lived. In its chemical composition it differs more remarkably from fire clay or clay iron stone. An approximate analysis of shales shews that organic matter and water compose 15 parts, and of the remaining 58 parts, one of solid materials, of which silt is composed. The next member of series is clay iron stone, differing in composition in different parts. It represents the great clay iron stone of the European coal mines. Connected with these, and often investing their surfaces, is the sulphurate of iron—an accompaniment of coals. Next fire clay: in this is distributed a small amount of organic remains. I mean remains of vegetables decomposed, or animals including fishes: we found its composition to vary remarkably from the other. Organic matter and water  $7\frac{1}{2}$  parts. Insoluble silt 66 parts; and that composed of silicia and pure clay. Pure clay with a little oxide of iron 10 parts, and carbonate of lime 14 parts. The mass of coal here is placed as it occurs in the mine, and has a portion of fire clay within the coal, shewing the process of its lamination. In the mine the fire clay is soft. The characters I have described are distinctive of the largest and best characterized coal measures in the world; it is rare to find all the members so distinctly presented. The sides of the mines as

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presented, represents roof and floor. [Illustrates it by the Court room tilted over.] An angle of about 74 in floor, and corresponding angle of roof. From inequalities of surfaces, there are slight variations of dip; the best mode then to ascertain would be by a plumb line, as by Professor Silliman; where lead strikes would be the floor. This is one variety of species of the coal called splint coal. This another variety—broken coal. This specimen broken last night, shews bands of coal and intervening spaces occupied by coal of another fracture; this differs but little in physical character from well known coals. This is Newcastle coal I believe, from its general character: same bands of compact coal, and lines differing remarkably. It has a little smutty matter between layers, and when broken presents a shining appearance. The Ayreshire is very shining and clear. The Pictou is very sooty. This is anthracite, from Shamok in Pennsylvania, and shews a bright band occasionally. This from Rhode Island, is a crushed coal, and must have been under violent pressure: is a fair sample of Massachusetts and Rhode Island beds. Other minerals are obtruded. When this mine was first opened it could not be used, but now is extensively used.

#### THE COMBUSTIBLE MINERALS AS A CLASS.

Bitumen in its varieties, including asphaltum from the Dead Sea, of Cuba, Trinidad, Barbadoes, Egypt, and South America, is separated by a wide interval, under a mineralogical arrangement from coals; of which there are two great divisions, bitumen and anthracite. Technically, we carry division further. Bituminous coal broken up into gas coal and forge coals. As examples of gas coal, we have the cannel coal, such as this. Others occupying intermediate stations, and which may be used for both purposes, as Pictou. The furnace coals, and for heating purposes, giving less flame, are extensively used in metallurgical operations, in reducing metals from their ores. For this purpose, coals for gas are not well adapted; and those are chosen which afford best and most coke. Those operations also extend to application of high temperature, to bring metals to marketable forms, and descend lower. The work of blacksmiths and brass-founders are best conducted with free burning coke, to obtain an uniform heat. In applying coals suited to gas, the gaseous part is the object, and is saved in metallurgical operations—coke or charcoal is substance required.

From this examination of properties of different coals, will be seen that selection made for purposes in view.

## PHYSICAL DISTINCTION BETWEEN BITUMENS.

Asphalten is name of a material found in Selles in France, consisting of limestone rock, impregnated with a semi-fluid bitumen—rock is brown and somewhat elastic, and of late years extensively quarried and used for pavements.

Asphaltum is a particular term of material, found at or near the Dead Sea. It can with propriety be applied to no other mineral production. It is a particular combustible mineral, which differs from other bitumen. I have been in Trinidad, and have seen the fluid out of which the solid asphaltum is formed. We see it from state of thin molasses to thick pitch—hardens by oxydation or exposure to air. When large masses are exposed to the sun, they change their form. Asphaltum can be traced to its semi-fluid state; but it has been found in rocks, in solid masses. In such cases, I believe it has become hardened by exposure to air. The character of asphaltum, is as clearly distinguished from coal, as light from darkness. Its being hard in this case, is one argument why not asphaltum. Bitumen can, under no circumstances, pass into such a material as the Albert coal. Taking the Albert mine as a whole, it is impossible it can be asphaltum. The opening could not have been filled up with liquid asphaltum, and produced the same form and appearance as this. Bitumen mines are not known to exist, in the true acceptation of the term. Assuming Albert mine to be filled up by bitumen, and supposing operations commenced after removal of a small portion, naked lights could not be burned in the cavity below, because they are constantly exhaling volatile hydrocarbons, which, when mixed with seven times their bulk of atmospheric air, will explode; so that in the present condition of the mine, if it were asphaltum, it would be impossible to carry light into it. Asphaltum deposits are worked in daylight. In Cuba, we have clay beds containing asphaltum, and worked in open day. Bitumen cannot, under any circumstances, be converted into coal. On application of heat to bitumen, when to 120, it softens and becomes ductile. Even by friction it emits odour, which is more distinct than before. A continued heat produces fluidity, by which it can be poured and spilt like water. At not exceeding 250, every variety of pure bitumen melts to fluid. I distinguish between bitumen mixed with clay, and those pure kinds, which leave but one or two per cent. of ash.

I made experiments with Professor Silliman—they were numerous. I performed many experiments on Hillsborough coal, before I came here. I have no doubt the article I used was from Hillsborough mine, from what I have seen here. I can't recollect first time. I



think as early as the middle of April, 1850, I made experiments, which were conducted with great care, on specimens averaged from the lot, and I came to the conclusion it was a highly bituminous coal. They were performed in consequence of arrival at Boston, of a cargo. The question of what it really was, and whether coal, was referred to me for solution. I then commenced experiments, taking it up as a bitumen, which it closely resembled. One piece I had, was like this of Dr. Leidy's. I had specimens extending to fifty pounds weight. I am in habit of analyzing cargoes of copper ore, and the parts I take are averaged on the whole cargo. The first experiment was with spirits of turpentine, the usual solvent with all bitumens: with that it was nearly insoluble; generally it dissolves Cuban asphaltum entirely, except a little ash; after several hours at boiling point, it retained its weight less seven or eight per cent. Cold spirits of turpentine will dissolve asphaltum. Pure spirits of turpentine, reposing on this [Albert] twenty four or forty eight hours, becomes colored. A piece of asphaltum in same time would dissolve. The turpentine takes nearly this depth of color from Albert coal. [Referring to Wetherell's bottle.] It is no test of its character, that it takes this color from turpentine. A portion of coloring matter is imparted to turpentine, and the turpentine itself becomes changed in composition. If you take 100 parts of Albert coal in fine powder, and digest it in boiling turpentine of ten times its weight, for some hours, we obtain a deep brown colored solution, resembling this (in Leidy's bottle). It is no test; for if we remove the colored portion and treat the residue with another equal portion of turpentine, a much slighter coloration takes place, even after continued boiling. If this be removed, and third portion used under the same circumstances, a slight coloration is produced, and if repeated, the turpentine is no longer colored at all. If the residue be dried at temperature, exceeding melting point of tin (450), and so long continued that it ceases to lose weight, we find that only seven or eight per cent. is lost of the original 100 parts, and this will be a constant result, however fine the powder be. On a most cautious evaporation of the turpentine, we find forty two to forty six grains of matter remaining. The turpentine evaporated alone in the same quantity, leaves about four grains: there turpentine gained more than coal lost—a change common in chemical operations, and often leads to great errors. The abolition of color is not confined to Albert coal. One variety of Scotch cannel coal gives a strong color to turpentine. We found one coal in the collection here, which had the same effect: it is the Ramsay Maine; it made the turpentine decidedly brown, but not so dark as this. In all there were eight speci-

mens tried, and three gave a color to the turpentine. I have tried it in benzole, resin, oil, linseed oil, sulphuric acid, ether, nitric acid, sulphurous acid, oil of vitriol. Most of these are powerful solvents and re-agents; and from all my experiments, I pronounced it to be a highly bituminous coal. I have tried experiments with Professor Silliman and Dr. Deck. I heard Professor Silliman yesterday, and I fully concur in all his statements, in regard to his experiments. We made a number of experiments with coal tar, and sought by all our means to dissolve the article in coal tar, and no solution on any occasion has taken place. We wished to know the temperature at which it fused, and to know whether we had made mistakes in our former experiments. In experimenting with coal tar, a large amount is evaporated and lost; and coal tar itself after being long or rapidly heated, becomes on cooling precisely like bitumen, and is used for adulterating largely the bitumen of commerce. I tried experiments with Dr. Wetherell's piece; the three of us could not produce such a piece from the coal. I cannot account for the manner in which this was produced by him. I can suppose that another material might have been introduced—a piece of asphaltum might have been taken in mistake; with all our efforts we could not produce it; and I know of no way in which that article could be produced from Hillsborough coal: I put some coal in this Florence flask, placed over a lamp—first effect was a little vapour of water; on increasing the heat, a white vapour appears about the sides, small drops of heavy yellowish oil were seen forming about the glass and running down the sides; and after a while we tried in vain to make it run over the side. We increased the heat and again turned it over; we wished, if possible, to produce such an article as Dr. Wetherell, if it could be done, but we could not. Applying a re-agent to this, it contained a large amount of Albert coal, and it produced a brown colored solution; but Dr. Wetherell's not so. We say that the article produced by Dr. Wetherell could not be produced from Hillsborough coal; it could not be produced by us. The coking experiments mentioned by Silliman, I witnessed and confirm. There is one thing I would mention in relation to this coal which I thought so highly bituminous—it gave us only 56.20 of gas, and 43.80 of coke, while Pictou gave 60.30 of gas, 39.79 of coke, shewing Pictou more bituminous than this. Averaging the whole produce of all samples from different parts of mine, and used in one powder, the Albert shewed 55.46 gas, and 44.54 coke, as average. I came prepared to shew from my first experiments, and to state the gas 60 and coke 40. I suppose the pieces I had were from the top of the mine; the last, however, I think to be

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exact, as it was from pieces from different parts of the mine. It seems now to occupy a middle station between the other coals. The view is theoretical, that the enormous quantity of animal remains, may account in some measure for the action of solvents. This coal gives an element of animal matter, the largest quantity I have ever found in any coal: it is called vegito animal matter. This mass produced by Dr. Robb—these are natural fractures of shales. This is what should result from the manner of formation. The material was like the finest starch or muck, at one time; such, falling into or coming into contact with crevices, would fill them: the shale is porous and would let off the water. There is evidence to shew that this is finer than in any of the body of the mine. If this rock were at the river side, it would fill up as this has done. A coal mine without that inclination in its place, would be a miracle. In many coal regions in France, the beds are nearly vertical; and there are other beds, as if shot off; and in England all are mostly horizontal and edges highly inclined. It would be a miracle if this mine were not as it is. I know Mr. Teschmaker: he has studied coals for ten years: his knowledge of the internal structure and minute parts, is greater than any man I know. Mr. Percival enjoys the reputation of being one of the most acute and accurate geologists of the present day. I would take his authority without hesitation. I conclude from all that it is a coal, and nothing else. Dr. Jackson is an eminent authority on this subject.

*Cross-examined by Milner.*

I have not personally examined the geology of this country except in neighborhood of mines. I call this an equivalent for fire clay, and I call it fire clay in the series. The fire clay in Rhode Island is coarse and quartz ore. I call it the fire clay of the series from its position and composition; the strata are much less twisted than I have seen in other mines, and are very uniform in appearance. The fire clays are much twisted and bent, and often intruded into coals. I will not say the mine is not half a mile in length. We walked more than half a mile in all, but not in any one direction. I ascertained its general average width. I found the fire clay most on the roof side, and very much bent and broken, and edge too in some cases, and even entered the coal. The dynamic cause of the formation I take to be the subsiding of the strata in the neighborhood. The cooling was the cause of the planes of cleavage. I think the coal was in its present solid state nearly, when the mass was upheaved. I think what is seen of the mine now, was far below the depths of the ocean at one time. I think there has been two actions here, an upward, and a lateral motion. The shales are not so much bent as the fire clay. Veins do not disturb

so much as other substances do. I do not think anticlinal axis can be brought into view here. An anticlinal axis may be caused by subsiding or by upheaving. I do not call that an anticlinal axis, where dips from one point in different directions. It would be a miracle for that mine to be in an anticlinal axis.

*Cross-examined by Kerr.*

I was called upon to make an analysis in April 1850. A cargo came to Boston. I cannot recollect when. It was much later. Mr. Cook applied to me. The coal was received for sale, and the officers of Custom House wished to know whether it was coal or not. I can't imagine parties interested in making it out coal or asphaltum. The analysis then was very similar to analysis afterwards. I have observed the formation of bitumen. I am perfectly acquainted with various samples of asphaltum. Asphaltum is only applied to substance from the Dead Sea, and there is no asphaltum in Trinidad. Asphalten is the name of a mineral from Selles in France. In bituminous lime stones. At Dead Sea it flows on water and is collected in pits. Asphalten is not known any where else than in France. Under the head of bitumen there is naphtha and petroleum. I have examined the bitumen from Egypt; I have chemically examined it within two years. I have examined material from Cuba. I have examined material in Trinidad, and without going to the pitch lake. I have never been in South America. The product there ranks as a bitumen and not as asphaltum. Bitumens are fusible and soluble in certain menstrua, and present in their masses no appearance of vegetable structure. Some are electric and some are not. Bitumen from Dead Sea and from Cuba shew electrical properties. I can't say bitumen from Peru or from Egypt do. Some specimens from Cuba shew more electricity than others. The experiments made with bitumen have always succeeded. I found a difference between Egyptian and Cuban asphaltum. Two fine specimens marked as coming from Cuba. I think this came from Dead Sea. I have neither Egyptian nor Peruvian here. As to Egyptian asphaltum it presents no appearance of lamination in large masses. This is a fair specimen of Albert mines. [Dr. Leidy's.] This is laminated, distinctly and beautifully seen. Stratification is judged of in the mass. This piece shews a distinct lamination. The Albert material differs from this in the proportion of foreign matter. Here are two sets of lamina. I find the lamination distinct in this Scotch coal, but the laminations to the same extent are not visible in Leidy's piece. I don't say I can see any lines of deposit in the splint piece. The conchoidal fracture depends upon the temperature at which it is broken. A small portion of Leidy's piece

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shews appearance of conchoidal fracture. I think more coals presenting conchoidal fracture than any other. It is due to homogeneity of composition in the mass. Any of these coals will exhibit in the small [breaks it] a low conchoidal fracture; and I do not see the same in the Leidy piece. The difference of the fracture is in the degree and form of the curvature. Pure bitumen is lighter than coal. The pure Cuban only four or five parts in 1000, greater than water. The impure parts would be heavier—that [Leidy's piece] is heavier than the Cuban. The Hillsborough material is as high as 1124, and down to 1096, as compared with water at 1000. I made my experiments on a variety of specimens from Albert mines. The material which comes from Trinidad, is called Trinidad pitch generally. I have also tried the pure bitumen from Trinidad, and found specific gravity vary but little. The asphaltum from the Dead Sea is very rare, and not much used in commerce. I included the foreign matters in making up the specific gravities. I believe there are coals lighter than that. The specific gravity of coal is generally greater than that of Albert coal. I think the run of English coal would be 1250. I don't know what causes the difference. The earthy matter in coals does not influence the specific gravity. I have spent a couple of years in geological observations. I spent parts of four years in the field. I have examined the Island of Antigua, Montserrat, and the Windward Islands—in 1836. I was employed professionally, to examine coal fields. I know that Professor Taylor published a very useful book, and I would assign him a high place among the geologists of the day. I cannot point out any traces of vegetable structure in that piece [Leidy's]. The bitumen do not contain any. Vegetable structure is not apparent to the eye. An effort might be made by a microscope, and it might fail. I think Dr. Leidy a person of high character. I have never tried a microscope; I use a lens. If a microscope exhibited a vegetable structure, it would be a fact gained; but if any found without it, it would be no proof. There is a specimen of coal here without vegetable structure. I have no knowledge of transmission of light by asphaltum or coal. Up to within a few years, not discovered that many coals had vegetable structure. I can conceive coals without vegetable structure; and in a coal produced by a fine liquidity, you might examine it for ages, and not find vegetable structure. I know Professor Bailley has discovered vegetable structure in ashes of anthracite. If ashes contained the cells of plants, then coal contained vegetable matter. The organic remains in ashes of anthracite—only observed four or five years ago—that is Rhode Island anthracite, and no vegetable matter discovered in it. Common English coals shew

remains of vegetable structure. In accordance with my personal knowledge in Trinidad, the bitumen had been in a state of fusion, and in the Dead Sea also. After exposure to oxygen, it becomes hardened. I can't pronounce whether that [Leidy's piece] has, or has not, been in a state of fusion. I have no knowledge of Dr. Wetherell by his work, and we judge of chemists by their works. If I had tried experiments as he did, and could not produce the same result, I should be bound to say I could not put confidence in his experiments. I don't know as to his ability. I have compared my specimens with specimens obtained from mines, and found them identical. The specimens taken from the vessel was not composed of same material as Albert mines. The Albert coal presents a uniform character in point of fusion. I have taken specimens from different parts of the mine, and made my inquiries under the greatest care. Dr. Wetherell said, he placed powder in this flask, &c., &c., [repeating what he said]. We applied alcohol lamps; in one case a spirit lamp, and in the other, an alcohol furnace, pipe placed in it, and that in water—if shut up, it would burst. If they had said they had melted it into liquid, I should not believe it; those seals present no appearance of having been in a liquid form; I know of no coal which can be melted without decomposition. When coals are decomposed, first a volatile body called naphtha comes. If a mine covered over with strata were to be heated, it would explode—the bitumen would be separated, and leave coke. As to chemical fusion of that coal, I say it is impossible. I have seen a map with names of Taylor and Robb to it. The mine does not now present the character which this exhibits, and this little diagram is entirely fancy. The coal being all removed, I considered it one level. I was engaged four days nearly in experiments. If I was satisfied that it was fusible and soluble, and had no vegetable structure, I should not say it was not coal. In all cases where bodies fuse, we watch with great care the point of heat. I should not believe it to be a bitumen, if it required 800 to fuse it. If entirely fusible at 800, I should not take it to be a coal. Among the resins, there is a difference in fusibility—would make no difference in a resin that required a different heat. Resins have fixed points of melting. Pure asphaltum melts at 214: that is a fixed point for bitumen below 250. All pure bitumens melt below 250, and if impure, we separate impurities. We separate impurities before we melt it: we solve it. Fire clay does not burn in ordinary beds; I don't think this will burn with flame [piece of fire clay]. The general geological character of the country has nothing to do with determining whether coal or asphaltum.

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*Re-examined by Johnson.*

The coal does not run as on this diagram. The conchoidal fracture is no test for determining character of the article. Specific gravity is no test alone of asphaltum, for Boghead coal is lighter. Lamination may be of different layers of the same materials; stratification may be of very different substances. There are a great many coals which do not shew lamination; and a large mass required to shew stratification. There are evident marks of stratification in the Albert coal. Crystals differ according to circumstances under which they dry. There is clear evidence of bed not being in same position as when deposited. It is most wrinkled in contact with the coal. Only two exceptions to shale, lying according to bed of coal. Specimens called commercial bitumen rarely pure; some mixed with coal tar. To be a special geologist, must be a general geologist, and a general geologist may not be able to determine as to class of mines. There are some gross inconsistencies on the map made by Robb and Taylor. The map published under Taylor's name is not correct. I think the introduction of Taylor's book is a translation. It is a common thing in coal not to detect vegetable tissue with the naked eye. The course generally taken for a microscope is to grind down a piece. The fineness of the material would have a tendency to destroy the cellular structure, and that fineness might be produced by fermentation. There are some 10 or 12 coals which would allow of similar impressions to those seals. They belong to fat coals. From St. Helens, Staffordshire, Whitecroft, Gloucestershire, ten yard seam of Wolverhampton, New Petton pit on Maine, Cannel, Elsecar low pit, Garsbeall Corvans and coals from Rawbondin, South Wales, and several American coals. This article not softened by heat till decomposition commences, and that renders it a coal. Beef melts by decomposition. A body may contain the same parts, but differ in their nature and character. The electricity is a most accidental quality. It is found in a degree in almost any substance. Its geological position is no evidence of its not being coal. Elliot and Gregg gave me the coal. My impression is that 60 per cent. is greatest amount of bitumen; eight per cent. greatest amount extracted by solution.

*Joseph Workman, by Attorney General.*

I am a blacksmith. I work at mines in the employ of Cairns. I have used the coal in the forge. The first winter I worked with it alone several weeks. I was doing iron work. Fitting out hoisting gear for shaft; no steel work. I have made an axe, and welded steel at different times: this is the axe, I made it last week. I don't pre-

fer it for forge, it gives too much blaze, and more expensive than other coals. The blaze is the only objection, which makes it disagreeable to workmen from heat, and he can't see the heat of his iron from the blaze. We use Grand Lake and charcoal; mixed with Grand Lake coal, it is good. I tried with asphaltum: this is a piece of it—Mr. Brown gave it to me, enough to make a fire with. I tried to weld a piece of trace wire like this: it melted and boiled like coal tar; no resemblance in behaviour of two. Albert coal softens, but does not melt. As soon as it melted, the ends of the iron turned black with it, until burnt off; there was no coke left, it all burnt away; I selected the coal myself. I cleared out the fire place, and used nothing else mixed with it. I welded this wire with some of the Albert coal.

*Cross-examined by Kerr.*

I put coke enough to kindle the fire. I could light the fire with shavings or straw, and it would make no difference. The coke I put in the fire was all burnt up, before I began to put steel in the axe. It softens and runs in the fire. I intended to say softens; it does not run like tar or resin. Running you would apply to a liquid, but this only softens; now and then it sticks to the iron a little. I first tried it the latter part of October, or beginning of November, 1850. I went to work for Cairns the 31st December, 1850. They commenced shovelling away snow for sinking shaft. The hole in the ground is ten feet long and five feet wide. I don't know where Brown got the material; he gave me what I considered sufficient, about half a peck. I think we used one chaldron the first winter. We had some from St. John, and preferred it.

*Re-examined.*

I only took coke to light the fire, and not to assist in making the axe. I took the coal as it came out of the heap.

*Herman Croker.*

I am a caulker by trade. I know Edgitt. I live on Captain Bennett's place. I was not there when Edgitt graved his boat. I saw the material he pointed out to me on a plank. I examined it, and the way I saw it, it was in a pile or heap, and the coal tar had run away from it on the board. I saw the coal was not melted, and said so to him; I never saw the boat. I am satisfied that article was not melted. I graved a vessel for Edgitt shortly afterwards with coal tar and pitch. I have tried to melt it several times and could not succeed; I tried in candle, in pots, in fire, and in spoons. The pile I saw was like pieces of coal in lumps, corners were smooth. It was summer of 1851, don't recollect particular time.

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*Re-examined.*

Edgitt's son employed me. Father and son live together in the same house.

*George Steves.*

I am a smith. I live in Hillsborough. I have been at mines. I live about four miles from them. I have used the coal at my forge the first time when Duffy worked them—not called asphaltum then. I bought a chaldron for forge, and employed a man to haul it. I worked it up. I think there was no other coal in shop. I found it to answer well. I had only one objection—a strong heavy blaze. I worked a chaldron up. I found it answered for ordinary country work—shoeing, harrow teeth, ploughs, chains. I have made, and laid with steel, a number of ploughs with this coal. It is a noble coal after it is charred a little. If I had a particular job, I would coke it a little, and then no objection to it. I can do rough coarse work in its raw state, I find no difficulty then but in the blaze. I got the chaldron near the end of spring; I have worked it in small quantities since; I have used a little lately; last week I welded an iron roughly. Some professional men and M. Barber came and brought a basket of this coal. I took charcoal out, except enough to kindle, and put this on, and put my iron in and welded it in their presence. Barber brought a box in sealed up and tied—he called it asphaltum: I tasted it—very different; I took the coal out and he put on the asphaltum; I blew with the bellows and saw at once it would not do, it flew away three feet from the vice and up the chimney, it was a liquid at once. I was afraid it would run into the bellows. I don't lay out to try it again. I have three specimens of iron work, done next day with the Hillsborough coal, without any difficulty. I sent my boy and got it from the wharf. This is another specimen made with it after the coal was coked; any sea coal is better to be coked. The master I served my time with, coked it for particular work: this is a piece of cast steel worked with it.

*Cross-examined.*

I will not say how long the Duffy coal lasted. I won't say but there was charcoal in the shop. I can't say what I paid, but it was selling for less then, than now. It is my belief the value of the coke is not known. The iron I welded I gave to Barber. I never saw Hillsborough coal melt and run in a puddle. In its softest state, if you put a cold iron in it, it would stick to it. After coal is put on, it soon forms into a crust; in its softest state, it sticks to iron more or less. The Hillsborough coal did not act like sea coal; I never saw a small

particle run. I have often thought it was just ready to go into liquid state, when it took fire. I have taken it out in such a state, and it dried up. I had an explosion in my shop when I was working the chaldron. I was making an extra heavy share, and put on a large quantity, and had a man there to help me : he blew it and let it lay some time, till I thought it was coke. I went to the bellows and blew ; an explosion of gas tore off nails of bellows, and then we went on and finished the work.

*Re-examined.*

I have been working other coal, when I have heard a little report at the mouth of the bellows. With the asphaltum, I had to blow to keep it out of the bellows, and blew it over the forge.

*George Peebles, by Johnson.*

I reside in Saint John. I am gas engineer in gas company at Saint John. I have been eight years in Saint John. I have used three or four cargoes of Hillsborough coal in making gas. I have seen a pile at the mines. In using it for gas, the coke from it is rather more porous than common run of bitumen coal, Newcastle and others. In a great many specimens of coke, I would not know one from another. I know cannel coal, Lesmehago : gas from it more, and preferable to gas from this. I think there is more from this : this produces richer gas ; and if burners were changed, I would think this as good. As to coal tar produced, I don't know any difference between this and other kinds of coal. Newcastle coal would produce 110 or 112 of tar to a ton. I have put on charges in three different retorts, three different kinds of coal, heated by the same furnace—Hillsborough, Lesmehago, and Newcastle : I left it in one hour—slacked off. I took out nearly two pails from each—so little difference, I could not tell. I put on doors and tried another hour—then I drew off again over half a pail full in each—no perceptible difference. I then left three and a half hours and took off door, and found a little coal tar in Newcastle, more than others—the Newcastle had the greatest quantity of coke. There were from nine to thirteen bushels of coke from Hillsborough coal ; Lesmehago, sixteen to nineteen bushels ; Newcastle, forty to fifty bushels. Newcastle, best coke in the world. I always bought this as coal. I got a little asphaltum from the Captain of the *Plumper* ; I tried it for gas for curiosity ; I could make nothing of it in the same retort as Hillsborough coal. I don't think you could make gas from it in ordinary gas retort. As far as gas making goes, Hillsborough answers as well as Newcastle ; this is a piece of Newcastle I brought with me ; this is Wemys coal ;

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this is Boghead coal ; this is Lesmehago ; this is Pic'ou ; this is cannel, the label off ; this Preston ; this Ayreshire. I sent all these specimens from Saint John.

*Cross-examined by Milner.*

I was at Halifax. I bought first cargo of Duffy. I think September 1849. I think was delivered there. I think then I went more minutely into experiments. I think you can take gas from Boghead, Wemys, and another, as quick as from Hillsborough. I think Hillsborough would give one half more light than Newcastle. I think Lesmehago gives a better light, but we have an instrument to test, which gives the preference to Hillsborough. We use it half and half with Newcastle. I threw the asphaltum into the retort and I could hardly get the doors on before it was running out. I could do nothing with it. You could not tell the difference in action of Hillsborough from other coal in the retort. It is hard to get two coals to coke the same.

*Re-examined by Johnson.*

No coke from the asphaltum. The Boghead produces more gas than the Hillsborough. We always mix coals when we can.

Adjourned.

**FRIDAY, JULY 30th, 9 o'clock.**

*Doctor Jackson—voire dire—in chief, by Gray.*

I am 47 years of age. I am a geologist and chemist. My residence is Boston, U. S. My earlier studies in 1824. I continued to study till 1829, when I graduated as M. D. For twenty years, I made chemistry, geology, and surveying mines, my particular business. I am a member of the Boston Society of Natural History, and am now Vice-President of it. I am fellow of American Academy of Arts. One of the Presidents of American Association of Geologists and Naturalists—Gentlemen engaged in geological surveys, and interested in botany, geology, &c., for mutual improvement from their observations. I am member of Geological Society of France, and corresponding member of others. I made a pedestrian tour in France, Austria, Switzerland, Italy, Bavaria, and other parts, to study geology ; which covers whole of middle and southern Europe. I have made geological surveys of several States. Maine, New Hampshire, Rhode Island, public lands of Massachusetts, and of mineral lands of U. S. in Michigan. I examined geology of Nova Scotia, parts of Canada, and portions of this Province. I published first geological memoir of geology of Nova Scotia. I am one of Assayers of State of

Massachusetts, and Assay Master for Boston ; engaged constantly in chemical and mineralogical researches. I made a special study of this portion of New Brunswick, in 1851. First trip, I arrived here 4th May, 1851. I was called upon professionally on behalf of Mr. Allison. I examined the mine. Snow on the ground then. I made then as thorough an exploration of mine as I could. Not so deep as now. I examined rocks, where exposed on hills and shores. I then satisfied myself they were all true members of the coal series. At this time I collected some of the fossils, took them home and ascertained what they were—true fishes of the coal series. *Palioniscus* is the name of the genus. The spheredra, a plant of the coal formation, I found in abundance ; and afterwards I found that plant represented as belonging to lower shales of Croton coal mines in England. This plate (1) is of *palioniscus*. This must have been at least 18 inches long. [Fossil specimen largest ] This is full grown. There are young fish of the same kind found in shoals. Large fish solitary. The genus *palioniscus* extend from the coal formation up into the magnesian lime stone. Never was one found below the coal formation. Not a fish in the old red sand stone, like the *palioniscus*. I was afterwards called here to meet Robb and Taylor. I arrived here 23d of May. I found them here, and invited them to visit the mine with me. We all went up to the mine, and just before reaching the mine we stopped and sat down, and there they wanted to lay down some principle, but each was to stand on his own bottom. We descended into mine—each took our observations. I had a compass and chronometer to measure inclinations. We all took separate measurements. Each pointed to the other some peculiarity. I came to no conclusion with them. I then made a geological survey of the surrounding country. I have the rough notes, and a published report of it. This map of country prepared by Foulis, for my use, to put upon it the geology of the Country. Upon this I have put down all the courses I have taken in the survey. [Mr. Gray offers the map in evidence. Kerr objects. Judge admits map to shew the places examined.] I came up by water and landed at Edgitt's wharf. Went back to mines, then returned to Saint John by way of the Valley. The first visit, I went from Cairns' to mines on the 4th May, 1851. Spent two or three days there to devote myself to the examination of coals and fossils. I went down, got shales and split them, open and disclosed the first fish which had been seen : a fish of coal formation. I also collected numerous specimens of plant called spheredra, and carried them to Boston. I examined the shores of the river below Edgitt's, and cliff below rocks at Edgitt's. Conglomerate

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is made up of variety. [Enumerates.] This dip to south, a little west, and passes beneath grey sand stone. This is a piece of grey sand stone with stigmara, well known characteristic of coal mines, called so from stigma, a mark. This is a plant belonging to the coal formation. I never saw any place except Joggins, where coal plants are more abundant. On Frederick's brook, I find grey sand stone with calamites; this is one. I find it also on shore. The grey sand stone at the mine overlies the coal and shales. There are alternation of shales with grey sand stone. We saw at the mine coal shales and fire clay, dipping down beneath the grey sand stone. Comparing the fossil plants in shales with those found in Europe, we have, 1st. The spheredra of lower shales of Croton mines; 2d. Lepido dendron gracille. I saw cut off, and carried away a plant of coal formation; 3d. We found large broad flag-like leaves, since supposed palms. Whatever they are, they are abundant in coal formations—Massachusetts, Rhode Island, Maryland and Virginia. I saw these leaves split off at mines. By uniting fishes and plants, they prove beyond contest that the rocks are of coal formation, and the spheredra tells us that it belongs to the lower members of the coal formation. On the second visit I obtained a larger collection to send away to Europe. On second visit I travelled to Baisely's farm, about 13 miles north west from mines. I examined rocks there supposed to border on coal formation. I found novaculite, bitumen shales or indurated bituminous clays. Next I went to Taylor's mills. I saw there a conglomerate resting on lime stone. Next I examined Whitehead: saw gypsum and red marl, and below that the conglomerate. I then visited Steves': found his gypsum quarry, and examined along Demoiselle road; and then at Milton's, and the gas spring near. I then went to a little lake called Granite lake: examined rocks north and north east of lake, and found same novaculite or green whetstone slate, same as at Baisely's; there a high dip (70), gradually diminishing towards the mines. We then travelled back to corner of lease, and found limestone: then examined a place at Martin's; found some coal on Hayward's brook: then went to Dr. Carey's; found a seam of coal overlaid by grey sand stone, and underlaid by fire clay. Along on shores of Petitcodiac River found small seams of coal, and at the base of cliff at Edgitt's. I should have been led to think, from general characteristics of the whole country, that coal would occur, or that it was a place for coal, without knowing there was a mine there. The direction of strata, north east and south west at the mine; the direction of bed of coal the same, and dip of 70 to north west; is parallel to stratification of the country, and is a bed between the strata. Next place, strata in

mine is much crumpled, shewing disturbance after deposition of strata, a very common phenomenon; and cases are known to me, where strata reduced to one tenth part their natural dimensions by lateral pressure. If you take a piece of cloth and grip it up it will crumple. I think same thing has taken place here by cooling and contracting of crust. We know there has been an elevation of rocks and lateral pressure. This bed is between strata and crumpled, and looking at it as a whole, no one can doubt this was formed in same manner. A mass of peat would by pressure bend the shales. Liquid is less compressible than solids. I find this bed having general bend of strata north east and south west, and dip of 70 to north west. The coal is columniac from side to side, or divides into prisms; this indicates that the coal has been softened in place. The columnian structure no more evidence of fusion than in starch, which is produced by drying; a result more of aqueous than igneous action. I examined this mine to see if any evidence of its having been deposited in layers. The lines in this specimen are lines of deposit; and these are what we call strata lines, which shew a deposit parallel to the walls. This could not have occurred from an injection of fluid mass. If made by infiltration through a cooling mass, it would have a different appearance. The position of its general structure is that of coal. The shales, or I would rather call them ductilitated clays, are highly bituminous, appear over an area of I should think 200 square chains, and uniformly bituminous; almost any of them burning in fire. These no more bituminous at mines than 50 chains from it. I can't divine any other way by which bituminized than by decomposition of vegetable matter. Bituminous matter is forming now at the bottom of peat bogs. I have found nodules of bituminous matter having a conchoidal fracture, and no appearance of vegetable structure. The shales must have been of same period as formation of coal itself. It is physically impossible that an injection of bituminous matter could impregnate shales as these. Bitumen is the result of change of vegetable matter—takes place slowly. Timber has been seen in Pompeii, bituminized by action of water and time, overwhelmed with water and mud, and overlaid with cinders, and timbers bituminized. We see lignites in all stages of bitumen, from charred wood to coals; and we come at conclusion as to fact but not as to mode. The shales must have been originally horizontal. By laws of gravitation mud on shores at high angle because shores steep, but at bottom horizontal. There is no proof of any of this mine being exposed to temperature above 300. Agent not igneous but aqueous. If it had been over 300 the shales and fire clay would have lost their water, and the carbonate of ammonia

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too. The rocks have not even been bakod. The then ingredients—water, carbonate of ammonia, and bituminous matter. The shales themselves bear no evidence of action of heat. Further, the organic matter, the substance of the fish is there, and contains between 15 and 16 per cent. of nitrogen, and would make it burn like a dry herring bituminized. From the special geology of mines, and the general geology of the country, I believe it to be a coal bed, and is in the regular coal formation.

#### CHEMICAL ANALYSIS.

First time I ever saw a piece of coal like this, was in March 1850—sent to me by Mr. Fuller of Boston. The piece he sent was very clear with conchoidal fracture, and my first impression was, it was bitumen; and being said to be near Saint John, which I had previously examined, and hearing it was in an upright vein or dyke, I thought it bitumen. I made an analysis to see how much volatile matter, how much coke, and how much ash, for commercial purposes; but not for discovering whether coal or asphaltum. I got further misled by an experiment. I pulverized it, put it into a flask and boiled it, and poured it on flannel. I filtered it. I saw solution strongly colored, and threw the filter in the fire without further examination. I then told Mr. Fuller it contained soluble bituminous matter, and asked whether I should examine it further; but in consequence of what he said, I made no further examination then. I was afterwards requested to examine a substance, which appeared the same material, said to come from Hillsborough; made analysis of it—ascertained bitumen, coke, and amount which could be dissolved in different menstrua: this was September 1851. I ascertained how much would dissolve. I boiled it in alcohol in fine powder, which took up a very trifling portion, of coloring matter; in ether, which dissolved a small portion about five per cent. of bitumen matter; boiled in oil of turpentine, corked tight, kept in boiling water some hours, then filtered through counterpoise, weighed and dried on paper, then filter washed by ether and dried at 212, and weighed again; aggregate weight of all which was dissolved or lost, was less than twenty per cent., about nineteen. This was the most severe ordeal I could at that time think of. I afterwards found on examination different solvents—benzole to be the cleanest and best solvent, and with that, the most bituminous portion would yield over twenty per cent. of soluble matter; I searched for a piece that would yield the most soluble matter. The solving is a mechanical separation of particles by a fluid, so that it will pass through a filtering paper. I then made a series of comparative experiments. I have over 15000

specimens in my cabinet. I found all the coals I examined yielded a portion of soluble coloring matter, but not so much as the Hillsborough coal; and more particularly to oil of turpentine. I then tried experiments on asphaltum from Cuba, Egypt, Dead Sea, and I found they dissolved immediately, so they would pass through the filter, except the ash. The Trinidad left some sand. In this article, what is left is still coal, and full of little cells, made I suppose where soluble matter had come from. From all these chemical experiments, I came to the conclusion that this was coal. I made also an ultimate analysis, and I find it made no difference by removal of bitumen: 75.2-10 per cent: carbon, 7.6-10 per cent. hydrogen, oxygen, and nitrogen; 17.2-10 nitrogen not yet separated. After all bituminous matter dissolved out, I found this composition, carbon 75.7, hydrogen 7.68, oxygen and nitrogen 16.62, shewing that the soluble and coal are isomeric, or same thing. Starch and gum are the same composition, but different in arrangements.

#### FUSIBILITY.

I took a sheet of platinum, put pulverized parts on it, and put it over heat to see whether it would melt, and I found they would not melt or agglutinate, or run in any way. A person can deceive himself by putting into flask or crucible, by pressing together and presenting a quasi-fusion. I then took asphaltum and put on platinum, and found every kind melted and ran over sheet instantly like water. I took a thick piece of lead, made a cup, rolled it up and put it up in a sand bath, and heated till the lead melted and ran away, leaving the coal unaltered. I then took a piece of coal and plunged it beneath melted lead, and held it there some time, and still not melted. I then took another forceps, and broke it under melted lead. I then took asphaltum and tried the same thing, but could not get it under the lead, it melted and ran over. I took melted zinc at 700, held coal under, took it out not altered, and took another forceps, and it felt elastic like India rubber. I tried asphaltum, and it melted instantly. I took melted tin 400, and could not get asphaltum under the surface. I took asphaltum in boiling water, did not melt, but added salt and increasing heat, it became soft. I endeavoured to form seals, and by heating it in flame of lamp I could make impression. I did same with Newcastle coal and other coals; it is not capable of fusion, properly so called; it will not fuse without decomposition. There are coals in which you can't find traces of vegetable structure—only fifteen years ago when first found out. There are portions of all coal in which no traces of vegetable structure found. It is a difficult thing



to prepare coals for microscope, and requires peculiar practice. I have seen John Bacon, Jr., of Boston, preparing coals. Grind a smooth surface on coal, and then put it on glass with Canada balsam, and then ground down carefully, then polished clear of all scratches, until perfectly smooth, then submitted to microscope. I have had some experience in it, and find it difficult. I gave Dr. Bacon a piece of Hillsborough coal for examination: he cut slices from different pieces. I saw them as he got along in the work. In many of the pieces we failed to discover any traces of vegetable structure. I then examined one piece, in which I saw distinctly the structure of a plant, the fibres and the cells. This was last autumn, October or November. I brought the coal from the mine myself. I have not the slightest doubt that the Hillsborough coal resulted from the decomposition of vegetable matter. It is very difficult to discover vegetable structure in some coals. The cellular tissue was not discovered in United States in anthracite, until a few years ago. I have made all my experiments as a scientific man. From all my experiments I pronounce this coal. I think Teschmaker unrivalled as to structure of coal, and I think he is not surpassed by any one in the world. Professor Silliman very high. Percival as a geologist, unrivalled in accuracy and acuteness of observation. Dr. Hays well known as a gentleman of great skill. All those men of the very highest authority in the United States. I know Ellitt, Torrey and Deck, and they are unrivalled in their respective branches.

*Cross-examined by Milner.*

The spheredra is very abundant. At first I could not find the stem, I only found the foliage in the under shales of the coal: these are in the coal formation. The spheredra I never heard of belonging to an old red sand stone; it is found in Pictou coal mines. Hugh Miller is not a good authority on this subject. There was a great difference between Robb and Taylor, and myself, as to dip. They took a curve round for a dip. I told them what they took for dip was not correct. I told them I should take my own observations. We went to inform ourselves by inspection and examination. If Robb and Taylor were to say, no difference of opinion as to mine, it would not be correct. When I examined mine before, it was only forty feet, now it is 150 feet, and shews clearly the contortions have nothing to do with the general dip. The curves of the strata are sometimes pushed into the coal, but nothing corresponding on opposite side of vein. We cut in six feet in one place roof, and then found strata parallel to bed. The polished surface of fire clay is caused by pressure and fineness of

material. I have seen coal beds form letter S. The dip on river, which overlies this, is a little to westward of south. I have been at north and south Joggins. The dip at south Joggins is south 20. There is another conglomerate west of mine, a mile to east of mine; conglomerate dips to east. On branch of Demoiselle brook, gypsum overlies conglomerate, which overlies the shale. A mile from mines, the dip in different places has nothing to do with it. The anticlinal axis is an imaginary vertical line—that is a folded axis. The anticlinal axis is only spoken of on a grand scale, and is not applicable to a small upheaving of the rocks—as inapplicable to small mine as to call ripples mountains. In a road on Frederick's brook, can shew twenty different crumplings of shales. I don't know that Joggins necessarily any connexion with this. There are three different deposits of coal, upper, middle, and lower. The old red sand stone, proper, is not known out of England. We have no old red sand stone till we get to Salisbury. I examined at Ayres' farm, and I could not find where petroleum came from. I saw no shales there, nor rocks near the spring. The shales at Baisely's farm dip north west. We can only find bits of the basin. It has been crushed. I can't tell where all the parts are. We have carboniferous rocks in all directions, and it is impossible for any geologist to trace it out. I think the outcropping edge of the coal is at Duffys mine. I can't give further information. The formation at Baisely's farm has nothing to do with the basin at mines. I should not be surprised if another mine of the same sort were found on Duffys lease; the reason is, that the strata dip in all round, as if it were a local basin; it is so crushed, you can't tell whether a basin or not. I am puzzled to know what has become of the other part of that coal bed. I don't think a geologist in the United States would risk his reputation in saying that the bed may not go to south east or north west below. I came for express purpose of ascertaining whether a coal formation, and I am satisfied it is. I say it was formed as a coal deposit, whether shape of wash bowl or Indian canoe. In Mansfield and other places, are coal beds, and no one can tell where the other sides are. It is even supposed that some are turned upside down. I don't know where this goes to; whether it doubles up or passes away to nothing, I can't tell. I do not say it is a coal basin, but it is a coal deposit. Novaculite is a hard slate, acted upon by heated rocks from below; the shales of the mine overlie that. There may be ages differ in formation of novaculite, and at mines. At one place dip 70, and about 50 chains dip only 20. The conglomerates belong to the base of the carboniferous group. I have never seen so bituminous a coal as this, and I never saw a bituminous coal mine in this country, with so high a dip. I saw some with as high, in

France. The coals near the river here, are nearer anthracite than at mines, and they are least disturbed—there is no sign of eruption. There is no evidence whatever that this is in an injected mass. I have examined in Italy and France, and never saw anything to support such an opinion. I know how asphaltum or bitumen is formed, and I know this is not formed in that way. I found fishes in mine; those I got were from the jog, and in that time in ground level. The jog has same character in surrounding rocks. The shales with the fishes burn from bituminous matter of fish—that with most fishes burns best. I got some fishes from the clay rock, south east of mine in the floor; fish are in other coal mines. *Palioniscus* is good evidence of coal. Professor Agassiz said, fish of coal formations had smooth scales. Genus *palioniscus* has a great number of species. I never heard of *palioniscus* in old red sand stone. I went to New York to examine Redfield's collection (they are of galloid order, genus *palioniscus*), and I could not find one. Hitchcock's geology would not be a good authority on this point. I know the genus *catophis* has been mistaken. We know a vast deal more since publication of Professor Agassiz' book. I have three *palioniscus* of other coal formations. One *palioniscus* different from those of Europe. They are not identical, but are the representatives. Some of the galloids may be in the old red sand stone. There is no reason to suppose these fishes in old red sand stone. These same species, as are moose and deer with Russians. Merely finding a *palioniscus* alone, without any other fossil, would not be of much value to prove coal formation, but would be strong reason to believe it to be. We know the fact that some species of fish die out, but we don't know why. Vegetable must have preceded existence of animals. Hall of New York is good, so far as his plates go. Sir C. Lyell is high authority. I spent more than six months study on the subject of the fishes. The fishes prove that water was over the deposit, and the species of fish shews epoch when existed. You find fish and plants without coal—may shew coal formation and a place for coal. The *spheredra* I took out of the mine myself. I got plant stems from Joggins, 1851, and sent to Boston. I found other plants in rubbish of mines—the *lepido dendron* and broad palm-like leaves, and *spheredra*. I found the *lepicrostobus*, the fruit of the *lepido dendron*. I found *calamites* at mine. I most decidedly consider the plants important in deciding as to coal formation. I think Edgitt's cape about three and a half miles from shore. I saw numerous *stigmaria* in rocks at cliff; whatever found in rocks above, has no relation to rocks below. If I found shales and plants continued from mine to Sussex Vale, I would say they were connected. If I

found asphaltum in a coal mine, it would not alter my opinion. I have seen maltha in a coal plant. I have seen bituminous gypsum in Dorchester. If asphaltum were found at Ayres' farm, coming up through crevices in rock, it would not affect the question—there still may be bituminous matter independent of mines. This is a fossil bitumen. [Stone with the bitumen produced by Robertson]. This being found in abundance in the neighbourhood, could have no influence on the question whatever. I have seen bits of asphaltum bitumen in a coal mine. I think where shaft ends at bottom, is only about ten feet to the level.

*Cross-examined by Kerr.*

The first time I came for Allison at the instance of Cook and Smith, New York, brokers. They applied in April 1851. I was up Saint John River 1836, 1837, 1838, and of city of Saint John, in 1827. I made accurate survey for State of Maine. I was on Tobique River. I was employed to come here professionally. I charged \$10 a day, I was about three weeks on survey. First time I saw Gesner, in 1829 at Parsboro. We had no quarrelling, no controversy in papers. I never published a word about him, but I may have said a great deal. When I saw anything he said I did not approve, I said so. He published some memoirs about Nova Scotia. I found fault with him because he would not give credit to Allger and Jackson. Old Mr. Silliman wrote to me that I ought to take it up and expose it. When I first came I could not finish my work, and returned in employment of Cook and Allison, and met Robb and Taylor. I differ with some men in some things. I think Hall makes errors in science. I no doubt make a great many errors. The first impression about this was wrong. This article is not by me or by my authority—[In American Journal of Science.] This I never saw till I saw it in the newspaper. [Looks at it.] I see some things here erroneous. The composition is correct. Dana gave it the name of asphaltic coal. This says it is asphaltum, and that is wrong. That is substantially the communication I made to the Boston Society of Natural History. I was in error in some things. I don't pretend to be infallible. The Society stands high, and their Journal is high scientific authority. It has an extensive circulation in this country and in Europe. Any person reading this might suppose it to be correct. I did not publish the article, and afterwards I corrected it before the Boston Society; and afterwards that statement was corrected, in the same journal: Fuller is a lawyer—a respectable man. I said it would soften and melt. I put it in a small thimble crucible, and it softened to such an

extent ; it was a compact piece ; splendid lustre, and had a conchoidal fracture. The only error is about its melting, and that is incorrect. I have known Dr. Robb about five years. He is a scientific man, and one for whom I have great respect. A good deal of scientific acumen. If he had explored the country a great deal, he would be well able to judge. I knew Taylor. He and I generally agreed. I knew him fifteen years. He was President of a coal company, and was a surveyor of mines. He had a great deal of practical experience, and I have often recommended him when I could not go myself. I went to mines with them. They wanted me to admit it was an injected mass, and I would not. I said it had softened in place. I have had some experience with microscope. I know Dr. Leidy. He is spoken of highly as an anatomist and entomologist. I know Dr. Bacon. I don't know why he is not here, of my own knowledge. I should have a good deal of confidence in Dr. Leidy's positive observations. Many coals are electric—the Breckenbridge coal, and the Petonia coal. I cannot see with naked eye any vegetable structure in this [Leidy's]. I heard Dr. Leidy's experiments ; they were all negative. There is a portion of this soluble. A thing must be fusible (so it must be melted and poured) to rank it as bitumen. If 15 or 16 witnesses were to swear that they melted it so as it could be poured, I would not believe them, because I have tried it over and over again carefully ; they were mistaken as I was. A man is bound to believe his own senses. I say I can't melt it. If I stood by and saw it done, and poured out, I would believe it. I challenge the trial. Twenty per cent. was most I could squeeze out. I can melt Newcastle coal so as to make an impression with seal. I never saw any coals melt and drop like sealing wax. I have tried all coals I could find—Cannel, Richmond, Pictou, and not more than five per cent. soluble colouring matter. Some resinous matter, for it is sticky. I don't know that it is resinous. I don't think resinous matter over one or two per cent. I did not separate them. Bitumen does not exist in coal, but is formed by combustion of coal. There was no bituminous matter came from the coal. You can make it almost drop from a specimen of Newcastle cannel.

*Re-examined by Gray.*

A microscopist might examine twenty specimens and find no vegetable structure, and on twenty first he might ; so that would counter-vail the twenty negative experiments. My subsequent examinations have confirmed my position to be correct, and disproved Dr. Taylor's. I think if Dr. Taylor could have seen what I have seen this time, he would have altered his opinions. My observations on the piece Fuller

gave me, was to determine its marketable value for locomotive and gas purposes. If I had kept my filter it would have shewn the residue in it. That same journal afterwards stated that the article was coal. This is elastic bitumen [in the stone produced by Brown]. The asphaltum mines in France, are small deposits of bitumen in crevices of lime stone opened to air—quantity not large; veins not larger than my arm. At Selles the asphalten is obtained: it is calcareous matter mixed with bitumen. I never heard of such a thing as asphaltum in a mine like this.

*Doctor Norrey, by Johnson.*

I reside in New York. I am Professor of Chemistry in College of Physicians and Surgeons, New York. I have held office since 1827. I am 55 years of age. I have made numerous chemical experiments on this article; first by action of heat alone, and of various solvents, and upon analogous substances of inflammables, taken from the earth. I have heated it by itself, open and closed, in vessels of glass and metal. I have not succeeded in properly fusing it. I have made it pasty, so it could be moulded; but not without destroying its nature. Inflammable air escapes during process of softening. I have tried Trinidad, Cuban, and Dead Sea asphaltum, in same way, and found they softened as shoemaker's wax, and can be poured out without altering their nature; but when I softened this, I could not get it back to its original state. I have tried all kinds of coal. I could lay my hand on some not affected at all, such as anthracite; others become flaky, give off gas, and leave coke, and others swell up and form bulky porous coke. I raised heat up to full redness under Albert material. I have tested by menstrua, alcohol, ether, turpentine, benzole, naphtha, and coal tar. The alcohol affected it slightly, and I did not prolong my experiment. Turpentine never took up to 8 per cent. of it. I have turned off turpentine and added fresh, till as far as I could tell it was exhausted. Ether dissolves much less. Naphtha about as much as turpentine. Benzole took up more; but with all the solvents combined, I could never get as much as 20 per cent. I have tried asphaltum, two kinds, the Cuban, and the so called Egyptian. My experiments chiefly with turpentine, which, in a cold state, dissolves it wholly, except a little sand and dirt. In coal tar the asphaltum melts at once, and combines readily. I took little lumps in some cases, and in other cases pounded fine and sifted through a lawn sieve, put it into coal tar, and heated it to make it about as thick as mush—heated it to boiling; it was diffused through it, and made a paint rather than a solution. I made a distinction between paint and var-

nish. If paint filtered, it would leave all coloring matter. I have no doubt a part fired out with coal tar, and when coal tar put on wood it sunk in, leaving powder on the surface. I came to the conclusion it was wholly unlike commercial substances called asphaltum, and I found no other place to receive it but coals. Some of the bituminous coals, when rubbed, have a slight asphaltic odour, but many have not. I have had a great interest in this matter, as a purely scientific matter : in every other sense it is a secondary matter with me. This has a slight bituminous odour, more than any coals, but far different from asphaltum. I have overhauled great heaps of it and found difference in structure, as you will find in any coal heap. I have seen large heaps of asphaltum. I have a barrel of it in my yard—there is a resemblance ; put pieces side by side, a person would at once detect the difference ; picked specimens might look alike. The powder of asphaltum is brown, while powder of all ordinary coals is black. This powder is black. I have used the microscope 20 years, studying anatomy of plants. To examine coal, the usual way is to grind down thin slices, glue to glass, and grind till light pass through ; scraping off, not so good as grinding. There is a great difficulty in getting thin ; not so brittle as asphaltum. Exposed to New York sun, it would melt on slate so as to flatten, but Hillsborough would not be affected at all. I know Teschmaker many years. I am not a practical geologist. I have turned my attention to geology for many years ; but I would not put my opinion against that of persons who have turned their attention to the subject more particularly. I have come to the general conclusion from what I have studied of geology, that this is a bed of coal. You may take it for what it is worth. I have found some specimens not electrical, while it generally is so, and a Kentucky coal is highly electrical. I could see no difference in structure, of the special electrical, and not. The fracture of the two substances, asphaltum and Hillsborough, are different ; this more of flat surfaces in breaking. In Cuban asphaltum there is nothing like a cleavage. In its fracture it resembles most coals.

*Cross-examined by Kerr.*

No man has a higher reputation than Dr. Leidy, of his age, as a naturalist. I have a very high regard for him. I was introduced about two years ago. None more expert with the microscope than he. I know Dr. Antisell, an excellent man in every respect, and a good geologist. What I have known of Wetherell is favorable. Dr. Leidy's results are negative : he may find it if he looks long enough in other cases. It was a long time before it was discovered in other coals. I allow a softening some way—call it a fusion when it fries

out. I have fried out some drops. A stuff will rise in a flask and fall back again. I call this a stuff which has been fried out [Wetherell's]: this is the greense, and the other is the scrap: this lump smells differently [Wetherell's melted piece. Judge smells it too—says it smells differently]. [Looks at buttons]—I don't agree these are fractures of fir branches. Alcohol is not a proper solvent for asphaltum. I can't say I have found a great difference in asphaltum in dissolving. The asphaltum of commerce is dug out of the ground. I should not judge this an impression of a leaf [Teschmaker's leaf on Leidy's bitumen]. I never saw a coal like Hillsborough. No two coals are exactly alike; there are properties in which they agree. This coal does not differ more from many other coals, than coals among themselves. I do not see any resemblance in it to Cuban asphaltum; that has a bitumen smell. I do not know so strong in coals; but nothing like asphaltum. If it be fusible without destruction, or being changed into another thing, then I would call it asphaltum. The residue you shewed me, is not the same as the coal: it is an altered substance. I can go so far as to say that the gentleman has made a mistake in saying it is the same: it differs in smell and in fracture. I have made no experiment with my own hands. My microscope examinations are so slight, they are not worth anything. I tried to grind it down, but could not. In the portions Leidy examined is no vegetable structure. So far as he went, he is entitled to credit. After it gets beyond hundreds of degrees of heat difference, then it would be out of the range of asphaltum. In standard works on mineralogy, bitumen has a certain fusibility; and if you find a new substance requiring several hundred degrees more, it would not rank as a bitumen, and if entirely fused, it would not be a coal. I put article and coal tar in an iron pot: we boiled it. I tried fairly and honestly, and could not succeed. I could not tell where it came from. Most of the specimens came from a great heap in the yard at New York. I do not think there is a great difference in the specimens. All Cuban I have seen is homogeneous: this is not. A pure specimen contains a good deal of earthy matter. It looks more like Trinidad. I consider Dr. Teschmaker high authority in mineralogy. I was not aware he had been studying coal.

*Re-examined by Johnson.*

All the asphaltums I have seen have a strong smell. All stronger than this. I have no doubt the residue of Wetherell's is a totally different article. When a substance fuses, it passes into a liquid state without undergoing a change. The fat part of this may be melted over again, but that would be pretty hard work. In my opinion



Wetherell has mistaken a product for a fused substance. Although this has peculiar characters, I consider it a new variety of coal. Boghead coal is different from all others in appearance. There is a vast variety of coals. It is not a fair way of testing this as a coal, to require that it shall possess all the properties of any other coal. Doctors Deck, Silliman, and Hays, experimented on Wetherell's piece.

*Dr. Ellitt, by Johnson.*

I reside in New York. Resided there till 1835: went to Carolina, remained there fourteen years, returned to New York in 1849, and there since. I am a chemist. I have been professor of chemistry. I was engaged for many years in chemical studies. Professor of Columbia college two years, and in college in South Carolina fourteen years. I am between forty five and forty six years of age. I have used asphaltum for various purposes twenty years ago, have not made a chemical analysis until a year past, with view to ascertain its properties. I have examined a great number of coals chemically. Coals very numerous in variety. I visited Albert mines 3d May last, and a week or so ago. I am not a practical geologist. I was called upon before the trial in Halifax to analyse Hillsborough article. I addressed myself to physical characters of coals and asphaltum, and concluded coals are distinguished by two properties, and they are negative. They are not fusible at any temperature without decomposition, and not soluble in any known menstrua. I found these properties appertain to coals. On the other hand, I found asphaltum—Dead Sea, Trinidad and Cuban—as well as a certain article resembling asphaltum (a fictitious article) coal tar boiled it to dryness. All agreed in being easily fusible in temperatures but little above boiling water. All entirely soluble, with the exception of foreign matter, in oil of turpentine and other menstrua, at ordinary temperature of atmosphere, 60 and 70. I have tried Albert coal in turpentine, benzole, chloroform, coal naphtha, petroleum naphtha, and certain other liquids which readily dissolve so called asphaltum. I found turpentine boiled to amount of 100 parts at least, to one of Albert coal: finely pulverized and sifted did not take up more than  $7\frac{1}{2}$  per cent. The residue when washed in alcohol and ether, and then dried, had precisely the aspect of the original. Similar modes were adopted in other solvents: not so large quantities, and similar results obtained. A small portion only was dissolved, and the residue possessed original properties of substance. I made experiments to determine whether asphaltums were different or same thing. The Cuban was the purest article, and no foreign matter. The other varieties same substance, but had foreign earthy

matter. Slight difference of odour and difference of aspect from earthy matter. Taking Cuban as type of asphaltum, it was readily soluble in ten times its weight of turpentine. So benzole is a ready and powerful solvent; chloroform too. From these experiments I came to the conclusion, that asphaltum very different in nature and properties from this coal. The line between them is very distinct. The Hillsborough not soluble, not fusible. I tried to fuse it in coal tar, without success. The coal tar itself is thick, and if put in powder and boiled might be thought fusion. If turpentine is then put in the mixture, it will solve the coal tar, and passed through a filter the coal will be left behind in its original character. Having heard a preparation of coal tar had been used as paint, I tried it. I took equal portions of Albert coal and Newcastle. I mixed each with equal weight of coal tar. Materials sifted through lawn sieve; solutions then thinned with equal portions of turpentine, and with one painted one side, and one the other. I applied a high heat, arising to decomposition of coal tar; this continued for many minutes. I could not detect the difference. This is the stove. There has been an absorption of the coal tar, and coal left on the surface. The coal and tar were in mechanical mixture. Coal tar is a solution of asphaltum. It is similar to naphtha on its way to asphaltum. The concave side is the Albert, and the convex is the Newcastle. The only time I heard of its mixture with coal tar was at Halifax. Had I taken fine sand, general result would be the same. I should think 90 per cent. of the coal remained undissolved. I made a great number of experiments in fusion, in New York. I have heated it cautiously—below 212 no impression at all made; and taking certain stopping points, tin melts at 442. Beneath melted tin, though melted for a long time, did not fuse. Asphaltum would melt immediately. Water boiled in a porcelain or glass vessel at 214. Asphaltum melts in it. Next metal is lead; melts about 600; then Albert coal if kept some time will soften slightly, but undergoes nothing which can be called fusion. Zinc melts at 700 or 800. I put it beneath melted zinc, it did not melt, but gave off gas and softened. At the first softening the decomposition commences. All bitumen coal will produce coal tar, and when it begins to produce it, it softens. I have tried in vessels of all kinds. I tried to fuse it in a pewter spoon. This is a portion of the coal, and this the spoon melted. Great care was taken to prevent sudden application of heat. Held six inches above candle, and brought down gradually till spoon melted and coal dropped unaltered. This is a spoon with asphaltum, treated in the same way: full of melted material. The material of spoons more fusible than either lead or tin, and would melt at 350. I got piece of

Wetherell's piece from Court, and attempted its fusion in a flask. Dr. Torrey was present, and half a dozen others. The circumstances were not of a refined kind. We tried it in tube of glass with a spirit lamp. On a cautious application of heat it swelled to about three times its original volume, began to give off white vapor and inflammable gas, which other bituminous coals give off under such circumstances. The tube was then inclined and shaken to try and cause it to flow down, and nothing ran down the tube. The coal was partially coked, and a portion of naphtha was with it agglutinated; a further decomposition then took place, and produced combustible gas. Trinidad asphaltum may be melted and solidified any number of times without loss of property. Sealing wax not fusible substance; the resinous matter holds the other in suspension. The part which Wetherell melted has not same smell as coal. I have seen Albert coals under hot sun, and it has a smell, but very different from Wetherell's melted piece. An organic analysis is no good test. If you submit the Lesmehago coal to same tests as Albert, the results are the same. Bodies may have the same proportions of same parts, and yet differ toto cælo in their character. Powder of this is black, so of coals. Powder of asphaltum of whatever color in mass, is brown. The transmission of light is not a good test. Difference in transmitted and reflected light. Certain colors are opposed to each other. A complimentary color enhances another. Sometimes fracture is columnian, sometimes conchoidal, sometimes long plane surfaces. Comparing with asphaltum and coals, I have no doubt this belongs to coals. I call combustible minerals such as are dug out of earth, as will burn: coals, sulphur, iron pyrites, fossil, resins. Freestone I would class as rocks, as contra-distinguished from minerals. Rocks belong to the mineral kingdom, but there is a marked distinction between rocks and minerals. Slates, granite, limestone, and gypsum, I put with rocks. Sulphate of lime I would call a mineral. As to electricity: asphaltums are electrical; coals generally are not, but a good many are, and some in a high degree. There is a difference, and a marked difference in portions from this mine. The glossier surfaces are more electrical. Glass sometimes is electrical and sometimes not. The electricity of a body is more connected with its mechanical character. Smooth and rough glass are different; one positively and the other negatively electrical.

*Cross-examined by Milner.*

I am engaged in pursuits of practical chemistry with Dr. Torrey. I have made experiments for gas company. I have no interest, direct or remote, in this cause. I made experiment with a spoon. I put the

article in melted lead. I made the experiment with reference to this trial [trial in Halifax], and for purpose of it. I tried the fusibility and solubility of asphaltum. If an article is fusible and soluble without decomposition, it is not coal. If it possessed absolute fusibility and solubility, I would not rank it with coal. If melted in salt water, the asphaltum would melt in the same temperature. I doubt whether an equal number of persons of respectability have examined bitumen at one time. I know Dr. Booth's book. I have never heard of asphaltum requiring over 214 to melt it. A substance called asphalten, when heated in ether and alcohol, will yield about 30 per cent. The asphalten itself will not melt under 500; but in its original state it melts easily. There is a substance in cuban asphaltum, which acts to a certain extent like asphalten. I kept a small fragment under the melted tin long enough to give it a good trial. In zinc it softened and commenced decomposing, but did not fuse. The Peruvian asphaltum does not itself require 500, but the asphalten, which is a constituent of it, after deducting 30 per cent. by solution. I passed it cautiously through every stage, from atmospheric heat upwards to melted zinc, and saw no melting. I saw a softening, which to me was evidence of decomposition. Beneath the melted mass, it never softened without the extrication of gas. The softening may take place to a certain extent before the evolution of gas. Coal tar is one of the most puzzling to chemists as a compound, when exposed to heat.

Adjourned.

**SATURDAY, JULY 31st, 9 o'clock.**

*Dr. Ellitt's cross-examination resumed.*

Certain particles go off at once. Coal tar part may boil, and part not. When I made experiment, hydro-carbon was being evolved. There is benzole in coal tar, and no doubt that was evolved; highest temperature we employed, was that of permanently elastic fluid or gaseous matter. The whole mass had the appearance of violent ebullition—in this state ten to fifteen minutes. It was stirred during process, and then applied to the wood. I made experiment to ascertain the truth or falsehood of what I heard: If Dr. Robb stated that he had boiled it, there must be some mistake. I don't think it possible I can be mistaken in the matter. The length of time to change character of coal tar, would depend on the mode in which heat applied. I can understand that lumps in coal tar would break up and be diffused, and be held in mechanical suspension by application of heat. According to my experience, it is not possible to dissolve it in turpentine and pass it through a filter. I made the experiment under

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such circumstances as enabled me to state that the gases did not escape from the other material, but was from the article. The essential aspect of the residue was the same. The residue was not sensibly or essentially changed. I know amber; I don't believe it fuses at all without changing its character; it is a fossil resin and mineral combustible. If there is an analogy between them at all, it is that they are infusible. I am inclined to think that anthracite in the mass would not sink in coal tar. I never heard of any experiments made with coal in coal tar, except what made with reference to this case. Sealing wax, in strict terms, is not fusible. It contains many particles not at all fusible. I would call it melting sealing wax. Blazing sealing wax evolves gas. Resin would evolve a gas, but would not be essentially changed in its character.

*Cross-examined by Kerr.*

All substances inorganic in their nature, belong to the mineral kingdom. Coals in New York belong to proprietors of soil, and therefore no such questions as this in United States. My first acquaintance with Robb was in Halifax. I consider him a gentleman of great scientific attainments. In metallic minerals are the ores of all the metals: iron, copper, zinc, tin, &c.

*Re-examined by Johnson.*

I heard Robb's evidence. Most certain way to dissolve it, is in powder, and not in lumps. I suppose there is neither asphalten nor petrolen in Albert coal. I am very doubtful whether correct terms are applied to asphaltum. From reference to Bousingart, both petrolen and asphalten are compound bodies. Wheat, flour, starch and gluten, and these contain oxygen, hydrogen, nitrogen and carbon. I never heard of asphaltum existing alone.

*Doctor Deck, by Johnson.*

I am an Englishman. I am practical chemist, and studied geology and mineralogy. I studied at Cambridge, England, under George Sedgewick; and chemistry, under Cummins. I studied chemistry at St. Thomas' hospital, under Dr. Leeson, a celebrated chemist. I afterwards practised four or five years in Leamington—about fifteen years in all. Eighteen months since I came to America. I reside in New York. I studied chemistry, and mineralogy, and geology, in Germany. I graduated at Vienna, Berzilius, at Stockholm, Sweden, and afterwards studied at college of chemists, Liverpool, and at Dublin afterwards, under Professors Ap John and Oldham, in Geology, Trinity College. I have been thoroughly occupied with these studies

fifteen years. I was in France, for observation. I examined coal at Mons in Belgium. I have examined mines in Pembrokeshire, South Wales. I have seen asphaltum in Switzerland, in Neufchâtel, obtained in oolite lime stone, used for purpose of pavement; it is open to air and is quarried; it is liquid first, and hardened by oxidation on exposure to the air. I have been here four weeks for the purpose of examining this mine, and examining geology of the country. I have specially examined different outcrops and sections in every hill and valley. The position of this mine is in upper secondary coal formation, in which workable coals are found between the transition series. The general geology indicates it as above the old red sand stone, and in new red sand stone, or true coal formation. The coal deposits here are similar to those in Warwickshire and Leicestershire. The coal beds in Coventry are precisely similar to this, except that the Magnesian lime stone there, in place of the conglomerate here, which contains seven and a half per cent. of magnesia. The gypsum and marls lie as in England, and below them are sand stone and shales. The strata here are distorted, but not beyond what I have seen in Wales and Belgium. The mines in Belgium contain three kinds—anthracite, bitumen, and cannel. One of them is very highly inclined, one place more than this, ranging from 45 to 75. In Tlackmanavshire, a vein vertical. In Wales, one worked very like this, leaving two walls, called roof and floor: when worked that way, called edge metals or edge coals. I found several fossil plants and fishes, usually accompanying coal fields, very similar to some I have from English coal fields. It would be impossible to tell whether in old or new red sand stone, unless he saw the accompanying rocks above and below. I was in Egypt. I saw asphaltum and petroleum springs, but no asphaltum. I believe Egyptian asphaltum, so called, comes from the Dead Sea. Thebes is 500 miles up from the sea coast. Springs are between Cairo and Luxar, in valley of the Nile: they ooze out of conglomerate of shale and slate; large quantities brought from Dead Sea to Egypt. I think it was formerly used for embalming. I have examined mummies, and believe it is the same in which they were embalmed. I heard of no asphaltum there; I heard it came from the Dead Sea. It becomes petrolien when much hardened. Taylor says no bituminous or argillaceous shales are found in vicinity of asphaltum, while highly bituminous and argillaceous shales are found in connexion with this mine. In coal mines nodules of iron ore are commonly found, and here I have found many. They are characteristic of coal formations; these nodules are similar to Coalbrookdale, England: these are specimens. This is a section of one containing

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a fossil. The presence of iron pyrites in this mine, is another indication. The blowers in this mine are another indication. Such blowers are formed from asphaltum, but the gas is different. This is bituminous carbonated hydrogen. This is fire damp, burns with pale blueish flame. In asphaltum, it is highly illuminating. In South America, one coal field is known which remains as deposited, according to Sir Charles Lyell, in which all the strata lie exactly parallel to each other. The rule is to find them disturbed. I am acquainted with Cuban, Trinidad, Egyptian, and asphaltum of commerce. Asphaltum is soluble in certain menstrua, and made valuable for varnish and cement, and coal is not so. I should say Hillsborough is highly bituminous coal. I have seen in Ireland below peat bogs, substance precisely resembling this, three to six inches thick, from what I remember of their fragility and appearance. In Hessia, near Gottenberg, a lignite when exposed to air became black, and was called pitch coal. Jet is found in tertiary formation, much later than coal; it is cut up for ornaments. The toad stone is above old red sand stone, and that is found in the conglomerate here. I have been at Baisely's farm, Wright's farm, and thirty miles round, and I am of opinion we are far above old red sand stone. I have found none of the accompanying rocks of the old red sand stone. What I saw is the asphaltum lime stone, and not black looking, the position of iron stone. The fossils, the iron pyrites, and what I presume a strict fire clay, mark this as a coal mine. I saw no appearance of fusion. Where igneous action has been at work, the lime stone has become hard marble, and the shales very friable. I saw no indication of igneous action here. I would call this a formation from aqueous action. I found several pieces of coal, which may or may not be mineral charcoal: these are they. I analyzed the fire clay with Dr's. Silliman and Hays. There is a portion of animal matter in the shale which causes it to burn. These are calamites found at the mouth of Salmon River, about twenty three miles from this, and I found stigmaria yesterday at Bennett's. These are in new red sand stone, which is connected with coal formation.

#### CHEMICAL EXPERIMENTS.

I made as many experiments as I could here, and in New York, on the article; and my conclusion is that it is coal and nothing but coal. I first tried its fusing power; it required a high heat to soften it, and then it decomposed, while asphaltum melted above boiling water. The solving experiments shewed it not to be asphaltum. I heard Wetherell's experiments. I tried all sorts of experiments in New York to make it fusible or soluble. I came prepared with all the best instruments

I could bring, for a general examination. With Silliman and Hays, we put some in a close flask and heated it to nearly a red heat; expected it to fuse; some of it coked; some of it distilled, and fell back upon it and dissolved itself. I find its own coal tar is its best solvent. We could not produce same result as Wetherell. We tried experiment on a piece given by Wetherell; it dissolved in turpentine, and was fusible. It was the coal altered; it was a distinct article. I use the microscope. I am not a professed microscopist. I would not look upon a microscope as a decided means, when chemical does not agree with it. I have seen Pritchard and Arenburg preparing coal for microscope, and preparing fossil wood. Sliced fine and rubbed down, and polished it till so thin, that it transmits light. I have tried by dissolving out ligneous matter. I have seen it attempted by burning and getting ash. I know all coals do not present a vegetable structure. Some from fermentation and other causes lose the vegetable structure. Such coals as Albert are known to shew no cellular tissue. Some coals are electric. Some varieties of this coal are not electric. I can tell when Albert coal is electric from its structure. So it is owing to the arrangement of its particles. This is an electrometer. [Tries a piece of electric Albert coal. Shews two experiments in which electrometer moves.] From all I have seen, I come to the conclusion, chemically and geologically, that it is strictly coal. I placed some pieces of asphaltum and Albert coal in the sun for three hours. I found all the asphaltum soft and impressible, while the coal was unaltered in any degree.

*Cross-examined by Milner.*

I am chemist and geologist. I am now engaged in manufacturing chemistry. I am now 31 years of age. I was brought up in laboratory. My father was employed as chemist in Cambridge, England. I have made scientific research my object through life. I commenced studying geology in Cambridge, and chemistry under Cummings. I studied chemistry in connexion with medical science. Being a medical man, I have examined geology more as an amateur. I first tried it about twelve months ago and found it would not dissolve, and laid it aside. About six months ago I examined it to satisfy myself, and found it was coal. I satisfied myself about it before I heard from any one of this dispute. I came to see whether the geological character agreed with it. I felt honored to have been selected to make investigation. I was at Baisely's farm. The dip of the rocks there about 15 north west. Some more, some less. I have been at Salisbury. I was at Edgitt's; the dip there is from 9 to 13 south east; at Cape Demoiselle creek, the same. This side of the mine it dips south east to



north west of mine; dip is 40 to 70. The dip of the Albert mines is to south east. I speak of the shales. The strata have been very much distorted. There may be another coal measure at Joggins. The Albert mine is included in shales. I should say 1700 or 1800 feet greatest depth to a coal deposit. The old red sand stone is below the coal measures. I am not aware that it is laid down that maximum thickness of coal, 5000 feet. I call this in the lower, secondary position of geologists; shale above and fire clay below. It lies below conglomerate, and is in the upper section of the coal measures in the carboniferous series, for I see no indication of the old red sand stone any where. I should think the Joggins formed a continuation of this formation, but they are in different basins. I should think it could not come out between this and the mines. The strata here have been very much broken and distorted. The general dip at Salmon River, south east—there an indication of its being a thorough coal country. The substance I saw in a peat bog in Ireland is a bituminous substance, is more like coal than peat. I took these specimens from mines with coal dust. It is possible this may be highly pulverized coal. I took them because Dr. Robb said he saw no coal dust.

*Cross-examined by Kerr.*

The eyes of the whole scientific world are upon us. I was employed two or three months ago by Mr. Cook and Mr. Allison. I expect to be paid. I wont say I may not be wrong. There are other coals which I know to be electrical, but there are none here that I would call so. I have never seen asphaltum reduced for the microscope.

*Re-examined by Johnson.*

I found coals in England electric.

*Mr. Kerr* offers evidence to rebut, by putting in license of Foster Bryant to shew the license to Duffy is void.

License offered in evidence to shew it embraces *locus in quo*.

*Attorney General*. It is not admissable, and is no answer to the defence; and suppose it embraces the *locus in quo*, it does not alter the answer made out by us, unless they shew an assignment from Bryant. [*Judge*. Does it not cut down license from the Crown.] It justifies nothing they have done, and is therefore no admission. If they intended to shew they claimed under this, it should have been part of their case.

*Gray*. This license not from proper custody. If they claim under it, it should have been part of their case. To make this available, it should be connected by assignment. It opens case to fraud. The

presumption is they have no assignment. Suppose 1st, lease to A, 2d, to B. Suppose B brought action for trespass, defendant could not shew lease to A. [*Judge.* This is inverting the case.]

*Johnson.* Both claiming under the Crown. Plaintiff showing a prior lease, would not interfere with our right. They claim by title which gives no right to mines. Their giving in evidence lease would be a new case—claiming as licensee of Crown. [*Judge.* No, cuts you down as licensee of Crown]. It could not break down our case, if we were claiming here as plaintiffs in ejectment—then a different case. *Ros.* 174. Same as if gave evidence of trespass on one act, and then offered evidence to shew another. If attempt to make title, then it cant be given; or if they give it, it shews title out of them, and therefore can't be given.

Judge admits the evidence, subject to the objections.

Lease from Crown to Foster Bryant, dated 10th August, 1841, for three miles square. Consideration £50, twenty five years. To be void, if rent behind thirty days; and if no effectual working and opening in two years, a right of re-entry. Adjourned 12 o'clock.

**MONDAY, 2d AUGUST, 11 o'clock.**

*Philip Palmer, by Kerr.*

[Bryant's lease read over]. I am Deputy Surveyor crown land office. I have been surveyor 41 years. I surveyed out Foster Bryant's license, July, 1841 [looks at plan of lease], before division of county of Westmorland. I had before that, laid off a license for John Alexander. I commenced at south west angle of Alexander's license. I then ran course of south line north 88, west six miles. I then commenced to lay off Bryant's license. I continued same course three miles, then south two, west three miles more, then at right angles three miles, and then at right angles three miles to starting point. This was done at Bryant's instance for him. I know where Albert mines are, I was there last Thursday. Those mines are within the bounds of this license. I should think the place where buildings are, and I saw them at work, is quarter mile from the north line, and from east line, half a mile.

*Cross-examined by Attorney General.*

I don't know where Foster Bryant is. I have never seen him since I laid out the lease. I don't expect he is in this country. I am satisfied Cairns' works are within the bounds laid out for Bryant's lease. Bryant had men sinking in shaft in Frederick's brook when I went out.

*Re-examined by Kerr.*

I never went out afterwards to see who was at work there. Where Bryant's men were at work, is about 60 or 80 rods from where Cairns is at work. I saw the place on Thursday last.

*Thomas Peck.*

Offered to prove that fire clay will blaze in the fire, to contradict defendant's witnesses in that particular.

Objected to, and objection sustained.

*John Steves.*

Is offered to contradict evidence by John Duffy, as to permission to occupy, and to shew that no license whatever was given, as stated by him.

*Attorney General* objects, that not admissable—that no foundation laid. Attention of defendant's witness should be called to time and place. He can't call evidence to destroy evidence of any witness.

*Mr. Gray.* We only offered evidence to shew adverse possession with knowledge and consent of owners of soil. Witness is interested, inasmuch as implied warranty on part of John Steves to his sons, that he had right to immediate possession. If an adverse possession, he could not sue on right of entry.

*Johnston.* John Steves liable under Act of Assembly, on implied warranty, and therefore directly interested.

*Kerr, contra.* We are entitled to shew by John Steves that no incumbrance created. They assume the fact of license which we can disprove. [*Judge.* No assumption—it is proved by Duffy. Suppose an express warranty a release necessary.]

Judge rejects the evidence, and reserves the points.

*John Steves* offered again, and produces a re-lease from James Steves and Dawson Steves, to John Steves, executed in Court.

*Gray* objects that this deed is to three as joint tenants, and liability to J. L. B. Steves still exists.

*Johnson.* Question is now whether witnesses liability is not wholly removed. Even suppose tenants in common, second could not release for third. As two joint tenants, case stronger. J. L. B. may yet be entitled as survivor.

*Kerr.* It is a joint covenant, and in such case two parties can release the covenant. It is a joint and not a separate covenant. No other way of getting at the fact. He is competent to rebut evidence as to fact of permission, and no liability exists as to warranty. If any liability, it is discharged by release of two.

*Attorney General.* The argument of joint covenant cannot prevail, for all must join to repeal it.

Judge still refuses the evidence, as outstanding liability to J. L. B. Steves not removed.

*Attorney General* offers Receiver General to prove the forfeiture of Foster Bryant's lease by non-payment of rent, and non-compliance of conditions.

*Kerr* objects. This cannot be done. Party should take out *sci. fa.* to repeal it. Receiver General is not the only person to receive. Lease says, or "to such other person as may be appointed to receive the same." Crown's grant can only be cancelled by matter of record. The Receiver General not having received money, is not conclusive evidence of non-payment. Party must have notice and opportunity to shew whether he has complied with conditions, and this is done by *sci. fa.*, and such evidence as offered now would not be sufficient to make the lease void.

*Judge.* Quoad the plaintiff and defendant, may not the lease be held void on non-compliance of condition.

*Milner.* Lease is under great seal. Assuming it is void on non-performance of conditions, it must be dealt with as a grant of land. If condition of grant was to clear so many acres, then *sci. fa.* necessary. When Crown grants by matter of record, it is only cancelled by matter of record.

*Kerr.* Stat. Hen. 8 and Edw. 3. Office found made necessary, and amounts to nothing until *sci. fa.* goes out. Crown can only be reinstated by matter of record. *Stephens v. Potter, Cro. Car.* 99. Rents payable to receiver or deputy, different from rent payable to Exchequer.

*Attorney General.* 1. Office found, and *sci. fa.* necessary: this is denied. 2. Matter of record necessary to reinvest Crown. Distinction clear between clause for entry and where lease made void, on non-performance of conditions. [Reads conditions.] *Chit. Prer.* 248, 9: office not necessary, when King's right appears in any shape of record. 249: in all cases where common person cannot have possession without entry, King cannot without office. "On proviso of re-entry and non-payment of rent, if rent payable at Exchequer and not paid, default appears of record." *Popham, 12 East.* 113: if rent payable at Exchequer, Queen might grant without office, for no payment entered default is of record. 17 *Vin. Ab.* 220. Case of intrusion when lease to be put an end to on notice. *Queen v. Hebert* (Allen's Reports). *Pop.* 25, Throgmorton's case. "Proviso is a limitation and not matter of condition;" p. 53. Receiver General office is same

as Exchequer in England for this purpose. Presumption is, Crown would not make second lease without authority.

*Gray.* Another clause in proviso. Plaintiff should have gone further, and have shewn performance of conditions. Broad distinction between leases and grants, and licenses to dig and mine. In the latter no estate is vested, and no escheat necessary. It is a mere permission to do a thing if done within a time, and if time elapses license is gone. Here steps taken equivalent to re-entry by Crown. *Doe Hanby v. Wood*, 2 B. & Ald. 724. Permission to dig, held no estate, only a license; and this shews that lease to Duffys is equivalent to re-entry by Crown.

*Johnston.* Distinction where power of re-entry given, and absolute forfeiture created.

*Mr. Kerr* in reply. Objection not answered. Matter passed by record must be restored by record. Receiver General's office is not office of record, as Exchequer book produced is not the record. The effect would nullify a large portion of licenses. May have been paid to somebody else.

Judge admits evidence, and reserves point.

*Thomas C. Lee, by Attorney General.*

I am Receiver General. I have been so since 1836, and I am still. I was Receiver General 10th August, 1841. I receive all monies, and make all payments connected with the Casual Revenue; All payments for lands, timber, fines, courts of law, sales of wild meadows, and rents for mining leases whenever paid; all monies paid in casual revenue is on ticket from crown land office. I can't receive it without that. It is sent to me, and money paid and entered in my book. Rents on mining leases are always entered in name of the original lessee. I have entry of 5th July, 1841: Foster Bryant paid £50 on account of mining lease. I have examined the books repeatedly, and I have no record of payment made since 5th July, 1841, by Foster Bryant. If any thing had been paid on his lease, I should have entry of it.

*Cross-examined by Kerr.*

I can't pretend to say his money paid into the crown land office. I have given no authority to any other person, nor do I know any other person authorised to receive. The monies are received at my office. I received rents from Peter Duffy—£5 on leases; next, 2d May, 1851, £65. Nothing can be received in casual revenue but by me. I can only know on what account and how much to receive, from the ticket sent to me. There are deputies, local receivers in the

Counties, and monies are sent to me. The rents are paid at Fredericton. I don't know if ever the monies received by the local receivers, but I don't believe it is so. Local deputies are appointed by crown land office. I don't know that they are authorised to receive monies on licenses.

*Re-examined by Attorney General.*

9th July, 1851, Duffys paid £40, 17th Oct., 1851.

Objected to after action brought, and sustained.

*Mr. Gray* offers evidence of tender of £65, before date of entry. Rejected.

*Smith* cites authorities.

License to Foster Bryant. They should shew he had raised material, before neglect to pay rent can avail to avoid it, and not bound to open a mine, and can't forfeit till opens mine.

*Stark. on Evid.*, 1099. Trespass. Possession actual or constructive necessary. He who has right may enter and may maintain trespass against one wrongfully remaining in possession.

GROUNDS.

1. The whole reservation, except as to gold and silver, void.
  2. Exception of mines and minerals—"void for uncertainty." Grant may be void for uncertainty.
  3. The exception goes to take the whole thing granted, and is therefore void. *Cro. Eliz.* 6, 244.
  4. Unless exception be taken in its confined sense of metallic minerals, and of same class which preceded. Coal being a combustible material expressed, all others of that class are excluded. A mineral is any thing that grows in mines and contains metal.
  5. The license is void, as it does not recite the grant in which the reservation is made.
  6. The license is a new contract between crown and licensee, and not assignable.
  7. License to Duffys void for non-payment of rent.
  8. License void in granting too much, more than crown had.
1. *Taunt.* 183. *Altersall v. Stephens.* The lessee recovered the whole damage. 1 *Cowp.* 9, *Moore v. McGrath.* *Tomlin.* Mines applied to all treasures dug out of the earth. 1. *Bl. Com.* 294. Right to Mines. *Taylor* 243. 4, 5, on coals.

*Kerr.* The case breaks down on the notice: insufficient, and affords no defence.

*Gray* cites as to sixth point. 6 *Bing.* 694. *Muscat v. Tozer.* Shews license to mine assignable. 7. *Eq. & Law Rep.* 595, *resemble.* Notice not in place of special plea, and is cumulative. 14 *M. & W.* 857. *Ross v. Wainman*, 5 *Law & Eq.* 526.

*Johnson. Roscoe* 489.

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*Attorney General addresses the Jury.*

Action for breaking and entering close. Two first counts founded on Stat. Hen. 6. If plaintiff recovers damages, he recovers double costs; and to recover, must shew freehold in plaintiff, and therefore can't recover.

Plaintiff must shew, when trespass committed he was in possession.

As to expulsion, he must also shew possession and expulsion.

I think 5, 6, 7 counts plaintiff can't recover. Even if he could, he must shew it to be asphaltum. Onus on him to prove it asphaltum.

If he shews it asphaltum, he can't recover.

*Principles of Law.*—Declaration lays trespass 1st January, and confined to 4th February. If party purchases, he cannot bring action for any thing done before his entry. A defendant may shew he is rightly in possession. If tenant at will, will must be determined. If from year to year, must have notice. Tenancy must be ended. If defendant rightly in possession, plaintiff cannot recover.

If a man in possession holding adversely, and owner sells while such possession, no right passes; for law says, chose in action not assignable. *Bac. Abrid.*

No doubt the whole object of the action, is to oust defendant of mines.

GROUND OF DEFENCE.

1. Defendant denies trespass on plaintiff. He had no title or possession at the time of trespass. 2. Defendant's lease from Crown, of mines, and plaintiff no right thereto. 3. Defendant took possession by consent of the owner of the soil, and erected buildings &c., and such license is irrevocable. A recognition of our rights, and persons purchasing from Steves are estopped from disputing. 4. If wrong on that point, and assuming defendant merely in possession of soil and no. of mines, defendant still, by authority of Steves, is a tenant from year to year, and we could not be put out before the spring of 1851. 5. Mining lease carries with it, as incident thereto, a right to enter and take away coal. 6. The article is coal and not asphaltum, and if asphaltum it is a mineral. 7. Assuming wrongfully in possession, and holding adversely, plaintiff has purchased a right of entry only, and his title is void. Proved defendant's possession not so large as Duffys. 8. Plaintiff has shewn no right or title to any of the minerals. Question whether coal or asphaltum, not absolutely necessary to settle in this case, although desirable to do so. Reservation of mines are for public benefit and are just.

EVIDENCE ON PART OF PLAINTIFF.

Cairns only ordered him out of mines and not off the soil. He did

not take hold of them and turn them off, and at this time Cairns had a right to defend his mines. This, therefore, is no trespass.

Robb says it is above, and Taylor says it is below coal measure. *Taylor 44.*

After John Steves allowed Duffys to go on, he is estopped from disputing it now, as the expense incurred.

*Gesner's Reports*, 1841, p. 27, 28; 1840, p. 66.

J. Steves recognized the lease from Crown, and right of lessee to take the coals, when he gave permission to Duffys to occupy and dig.

### TUESDAY MORNING, 8 o'clock, 13th day.

*Mr. Kerr addresses Jury.*

A conflict between government and people. Office holders backed up by foreigners. Question, whether you are to be freemen or slaves. The Crown license carried out, minerals will take every thing and leave you mere serfs. *Berton v. M'Mahon*. Case before Court. Government waiting. Warns jury of result. Real defendants here Anthony Cook and Allison. Cairns is only an agent.

Coals by laws of England go with the soil.

Cause of revolution in States, was reservations in grants. [Judge. New idea.]

Four of Counsel are members of Assembly, and intend to secure Bill next Session.

We go for trespass to land and for asphaltum.

First two counts we gave no evidence on. Third count. [Reads it, and admits no evidence of cutting trees.] 4th count: expulsion; expenditure by plaintiff, £25, when driven off by defendant.

Statute of frauds requires a writing, or tenancy at will. When Steves sold, it put an end to tenancy at will. When Duffys assigned, it put an end to the tenancy at will.

In Duffys assignment he stipulates to use his influence to obtain a lease from owners.

Brown gave no evidence of transfer of license from Steves; as a personal permission it could not be transferred.

Cairns set up no authority under Duffy or Steves at the time, and cannot now do so.

Upon the third count they were trespassers for entering and working. Upon 4th count: they expelled us from our shaft after we had spent £25.

Let the coals go to the owners of the soil.

*Taylor*, 244, says asphaltum used by smiths in Cuba. [Refers to Jackson's report as in *American Journal of Science*.] Supposes a trial in Halifax, and verdict for plaintiff on same evidence as here.



The Bryant license put in, and if said that is void, then the other void. If Bryant not void, then cuts other down.

By a verdict for defendant you will surrender your rights. The case is yours. And if for defendant leases will come down like hailstones.

Suppose verdict for plaintiff, as jury of Halifax did, then you will fortify your title and make your lands more valuable. And your lands £100 each of more value.

Out of 68 leases 64 void.

If 200 chaldrons, give us verdict at such moderate price as you may deem necessary.

MEMORANDUM OF JUDGE'S CHARGE.

The declaration contains seven counts. The two first are on the statute of *Henry 6*, for forcible entry and detainer, and are not supported by evidence, and therefore no question arises on those counts, and I must instruct you to give your verdict thereon for the defendant.

The fifth, sixth, and seventh, are for digging and carrying away asphaltum, and for breaking and entering asphaltum mine of the plaintiff. Upon neither of which, in my opinion, is the plaintiff entitled to recover; for admitting the article to be asphaltum, it is admitted and proved to be a mineral, and is therefore, in my opinion, within the reservation of the grant to George Steves, and does not therefore belong to the owners of the soil.

You will therefore consider the evidence with reference to the 3d and 4th counts, according to the rules of law I shall lay down for your guidance.

To entitle the plaintiff to recover in this form of action, it lies upon him to shew that at the time of the trespass complained of, he was in the actual, or the constructive possession of the place, in which the trespass was committed. Actual possession is being on the place, and exercising right of occupation. Constructive, is that possession which accompanies a legal title, and a right to possession; for in such case, the owner is not required to walk over his property to preserve possession, but is deemed to be in possession by virtue of his title.

If Duffys or Cairns were holding adversely at the time of the assignment to the plaintiff, such assignment would not take effect as covering a mere right of entry. But I am of opinion there is not sufficient evidence to shew such adverse holding. On the contrary, there is evidence to shew that the defendant did not pretend at any time to claim any right to the soil, but only to the mines and minerals.

There being therefore no adverse possession of the four acres, so

far as regards the soil, I am of opinion that the lease to Milner and assignment to Gesner would take effect to pass the possession, unless some other legal impediment existed; and this brings us to the question, what right did John Steves give to Duffys in 1850? If you believe from the evidence, that John Steves at that time authorized the Duffys to go on and work until the following spring, as they had done during the previous year, and that such authority was clearly intended by John Steves to cover all such works as were necessary for the prosecution of the mining operations, then as John Steves himself could not have maintained an action for the trespass complained of, so neither can the plaintiff in this case; and if such be your view of the evidence of John Duffy, your verdict will be for the defendant on the whole declaration. But on the other hand, should you be of opinion that no such authority was given by John Steves, then your verdict will be on the 3d count for the plaintiff, for such damages as you think will compensate for the digging of the shafts and encumbering the soil, and other acts proved to have been committed between the 1st January and 4th February, 1851.

As to the 4th count. The question for your consideration is, did the defendant expel the plaintiff from his close. If he did not, even admitting no authority from Steves, then plaintiff is not entitled to recover on that count. The evidence shews an expulsion from the shaft clearly. And with regard to the reservation in the grant, I have to direct you that the Crown had full right to make such reservation, and that it is not void. But at the same time I must inform you, that such reservation does not, as a legal incident thereto, give a right to the Crown, or its lessee, to do any act on the land which will injure the surface, and that therefore an action lies by the owner of the soil against the licensee of the Crown, for any such injury.

As to Duffys lease, I am of opinion receipt of rent in May, 1851, is in law a waiver of the forfeiture. The case cited must be taken with reference to the time.

While I do not consider it important in deciding this case, whether the article be coal or asphaltum, for the reasons I have before mentioned, yet as so much trouble has been taken on either side, in reference to this question, I shall ask you to say in your verdict which of the two you consider it.

In submitting the case to the jury, the Judge presented in substance the following abstract of the points in issue, as to the character of the material.

[See next page.]

Jury out twenty minutes. Verdict for defendant, and Jury say, we believe the material to be *Coal*.

**ABSTRACT OF POINTS IN CHARGING JURY, AS TO CHARACTER OF MATERIAL.**

I. GEOLOGICAL.	PLAINTIFF'S EVIDENCE.	DEPENDANT'S EVIDENCE.
<p>1. <i>General.</i> Position of mines and surrounding strata.</p> <p>2. <i>Special.</i> 1. Internal structure of mines.</p> <p>2. Structure of mineral.</p>	<p>1. <i>General.</i> An anticlinal axis. A vein not a bed. An injected mass thrown up. Strata distorted. No conglomerate above and below. No parallel strata of coal beds. No roof, no floor, no fire clay, and lies beneath coal formation.</p> <p>2. <i>Special.</i> Amorphous. No vegetable structure. No cellular tissue. No lamination, and transmits light.</p>	<p>1. <i>General.</i> No anticlinal axis. Is a bed—not a vein. A deposit, and not an injected mass. Strata parallel. Has roof, floor, fire clay, and coal fossils, and is just where it ought to be, in the coal series above old red sand stone; and it would be a miracle if a coal bed were not there.</p> <p>2. <i>Special.</i> Has indications of vegetable structure. Distinct laminations. The evidence of its being amorphous only negative as to a few particles. Taylor in his cross-examination says 'In an asphaltum—no shales, no fire clay, no fossils, no iron stone, lime stone, sand stone, or sulphurate of iron.'</p>
<p>II. MINERALOGICAL.</p> <p><i>Shewing the difference or resemblance between asphaltum and coal in</i></p> <p>1. Density. 2. Fracture. 3. Cleavage. 4. Odour. 5. Electricity. 6. Lustre. 7. Charcoal dust.</p>	<p>1. Density—less specific gravity than coal. Specific gravity 109. Asphaltum 100 to 120. Coal 120 to 175.</p> <p>2. Fracture Conchoidal. 3. No cleavage, which coal has. 4. Odour like asphaltum. 5. Is negatively electric, coal not so. 6. Lustre brighter than coal. 7. No animal charcoal, which coal always has.</p>	<p>1. Some specimens of coal less than this. 2. Many kinds coal conchoidal fracture, and many other substances as flint, glass, &amp;c. 3. Has distinct lines of cleavage. 4. Odour not at all like asphaltum. 5. Kentucky electric, and some asphaltum not electric. 6. Anthracite coal as lustrous—some pieces. 7. Several pieces of this shew charcoal.</p>
<p>III. CHEMICAL.</p> <p><i>Fusibility and Solubility.</i></p> <p>1. Positive.</p> <p>2. Comparative.</p>	<p>It is fusible—melts by heat, and is the same after melted as before—is soluble in coal tar, in turpentine, in naphtha, and in other menstrua.</p>	<p>Will not melt by heat without changing its character by throwing off gas. Every known variety of asphaltum melts at not exceeding 350; and after known asphaltum softens in hot sun. Sun no effect on this.</p> <p>When apparently dissolved in coal tar, it is not dissolved, but only held in mechanical suspension.</p>

# APPENDIX.

## A.

The examination of Richard Cowling Taylor, a witness produced, sworn and examined, at the house of Andrew Weldon, Esquire, in Dorchester, in the County of Westmorland, on the part and behalf of Abraham Gesner, plaintiff in a certain cause now pending in Her Majesty's Supreme Court of Judicature for the Province of New Brunswick, against William Cairns, defendant, before me, the Honorable Amos Edwin Botsford, the sixth day of June, in the year of our Lord one thousand eight hundred and fifty one, pursuant to the order of Mr. Justice Parker, made the second day of June, A. D., 1851.

The said Richard Cowling Taylor being sworn on the Holy Evangelists of Almighty God, deposes and says in answer to questions put to him by Christopher Milner, Esquire, the Attorney for the plaintiff,

"I am a native of England, and a citizen of the United States. I am a geological surveyor, or mineral agent. I have been engaged in that business since the year 1810. I have published various works on the subject. I am author of a work, entitled *Statistics of Coal*. I have a good knowledge of mines, and of coal in particular. I know of no other author of a work called *Statistics of Coal*, but myself. I have resided for twenty one years in the State of Pennsylvania, and during a large part of that time in the city of Philadelphia. Geological and mineral agent are synonymous terms. Coal occurs in a distinct form, known as the "coal formation," by geologists; which formation includes both anthracite and bituminous coal. The origin of coal is universally ascribed to vegetable productions which have undergone certain changes. Vegetable substances, originally occupying the surface of the earth, have been by geological changes covered over by other substances. 'Strata' would express my meaning better than the word 'substances.' Coal forms part of a large group or series of strata known by the general name of the 'coal formation,' which includes the whole series. Coal is the same age as the whole group of which it forms a subordinate member. Coal occurs in sedimentary rocks. The coal formation is composed of sedimentary rocks. Coal is recognized always by the peculiar plants which have led to the formation of the vein, and which plants also occur in the contiguous strata above and below; that is to say, in sand stone, slates, and fire clay. Coal is a parallel and continuous seam with the whole coal formation. Coal seams in general preserve their uniformity of thickness for considerable distances, and are always parallel with the sedimentary strata of the coal formation. I have visited the county of Albert recently. I have visited the mine in Hillsborough. That mine is three or four miles from the Petitcodiac river. I examined that mine in company with Professors Robb and Jackson, and Mr. Foulis and Mr. Brown, the managers. I was there on Saturday, 24th May last, with Dr. Robb, Mr. Cairns and Mr. Brown. On Tuesday, 27th

of same month, I was down in the mine; Drs. Jackson and Robb, Mr. Foulis and Mr. Brown, were with me in the mine. I examined the mine on both days. I made up my mind that the substance found there did not correspond with the usual characters of a coal seam. It differs in the first place, in having no conglomerate above or below it. It has no fire clay above or below it. It has no vegetable impressions common to coal seams. It has not that perfect parallelism of its walls that coal seams usually have. The strata of the two sides are dipping in opposite directions. In some part of the excavation or level, the two sides of the seam approach to parallelism. In other parts of the level, and more frequently, the two sides are not conformable, and on the eastern side are much distorted. The coal seams do not diverge or cross the stratification. The vein spoken of ramifies into separate veins, and receives and gives out smaller veins; which veins occasionally re-unite together again after certain interruptions of the stratification. I formed the opinion that this vein is obtrusive and thrown up from beneath. That it is a fissure occurring in the rocks, which fissure was filled by the mineral substance under investigation. That the vein occupies a line of dislocation in the manner of a very steep anticlinal axis; the occasion of which gave rise to a local throwing off of the contiguous strata in opposite directions. In fact, so far as appearances justify the remark, the vein itself was thrown upwards in form of a wedge, the force proceeding from below. The distinction between it and coal is in the nature of the substance itself. I formed the opinion that it is a mass of matter injected whilst in a liquid, soft, or melted state, which after cooling presents its present appearance. I observed that the mineral substance of the vein preserves a horizontal direction or nearly so in its planes of sub-division, which occasionally give it an approach towards a columnar structure in that direction; consequently those divisional planes present themselves at right angles, or nearly so to the bounding walls, as has been observed in other places where veins of asphaltum or igneous matter, such as basalt, have been ejected, where the columnar structure always arranges itself under the process of cooling, in a direction at right angles to the walls. I found the calcareous slates on both sides were highly charged with bituminous matter. This vein appears to be inclosed in a series of calcareous and bituminous slates; which series occupies a belt or range passing through the country somewhere in a north east and south west direction; the breadth of which is considerable, but which I am unable to state. The series of bituminous shales appears to come from beneath the group, which is generally known as the old red sand stone, and to overlie an older rock which is generally denominated a metamorphic slate or rock. The coal formation overlies the old red sand stone, therefore it gave the impression to me, from observation, that the old red sand stone group was interposed between the coal formation and the bituminous shales, in which this substance is found. With reference to what was said of the interior structure of the veins, I would add that whereas in coal the divisional planes are parallel to the walls; those of this injected matter are arranged transversely to the walls; which had a considerable influence upon my mind in forming an opinion as to the character of the substance. I also concluded that the contents of the vein were posterior

to the age of the surrounding shales. I consider the substance in question, from my general knowledge, to be asphaltum and not coal. [Mr. Milner here asks the following question: "Was there any dispute or difference of opinion on the last day you inspected the mines as to the substance being an injected mass?" Messrs. Bliss Botsford and A. L. Palmer for the defendant, objected to the question as improper to be put. Witness answers thus to the question: "There was no dispute or difference of opinion."] Dr. Jackson assisted me in exploring the mine on the second day, in taking admeasurements, the angles of dip, the ranges or courses of stratification, in tracing the principal geological features developed in the interior of the vein, and in making notes or sketches of the same. In all those admeasurements we had each his own instruments, and we all agreed as to what we should enter in our books. We consulted together as to what our figures should be, so as to have the material data alike. I mean by we, Drs. Robb, Jackson, and myself. I have been in Cuba, and have examined asphaltum mines in two or three parts of that Island, and not elsewhere, as there are but few such mines in the rest of the world. The deposit in Hillsborough is similar in many points, as to its characteristic geological features, to that of Cuba. I know nothing of the chemical composition of the substance in question, as chemistry is no part of my profession. The external characters of the Cuban asphaltum slightly differ in some localities of the same Island, some being more compact and lustrous in their fracture than others. The Hillsborough substance approaches to the more compact variety in Cuba, but is still more lustrous, and possesses a more splendid black color. I have no doubt of the character of this substance. I believe it to be asphaltum in some one of its varieties. I do not believe it to be coal, or any variety of coal."

And the said Richard Cowling Taylor being cross-examined by Bliss Botsford, Esquire, on the part of the defendant, further deposeth and saith: "I came on here in my professional capacity, employed and paid by Dr. Gesner or his agents at New York. I was informed by Dr. Gesner that I was to be a witness on his part in certain causes relating to this matter. Dr. Gesner did not accompany me all the way to the mine, but came with me from Halifax to Hillsborough, and lodged with me there at Mr. Edgitt's. I reported to him the results of my observations at the mine, on my seeing him afterwards. He asked information from me relating to my observations, and I gave it to him to some extent, but stated that I wished to draw my conclusions unfettered by any. He did not put many questions to me. He most likely inquired of me about the general features of the case, but I was somewhat reserved in my communications to him. I did not conceal from him my opinion of the article. I came to the solemn conclusion that the substance was asphaltum while in the County of Albert. I expressed no doubt while there that it was asphaltum. I probably mentioned my conclusion then to Dr. Gesner. I was satisfied after my first visit that it was asphaltum. I never in the United States said the article was coal. I gave my opinion to Mr. George E. Cook, that the article was asphaltum, and compared it in his presence with two specimens from Cuba, and from different localities there. I

saw some shale there at the same time presented by Mr. Cook. He sent me printed certificates, as to the analysis, by chemists of high standing, viz: by Doctors Torrey and Chilton, and by Professor Booth. I do not recollect the analytical contents of those certificates. There was no difference of opinion expressed in them. Mr. Cook did not name the article to me as either coal or asphaltum, but asked my opinion of it. From comparison alone I decided it was asphaltum, but I did not wish to be quoted as giving my opinion on the subject, until I should have had further means of forming a decision. I am no professional chemist. I always employ one of that profession where I require his opinion. Looking at coals in the same way I should decide upon their character or species. If I had two specimens placed before me, one of true coal, the other of asphaltum, each having its peculiar characteristics, I should be able to form a conclusion under what head to place each, but I should like to be fortified in that opinion by a view of the geological peculiarities of the surrounding country, and by a chemical analysis of each specimen. If the geological and chemical analysis of a substance differed, I should be governed by my own geological experience in the one case. As to the chemical analysis, I should of course be unwilling to oppose a chemist on a chemical subject. The chemical part of the subject I should leave to chemists. In such a case I should offer my opinion as a geologist and not as a chemist. I have seen no statement where they differed materially. It is a question to be decided by a geologist rather than by a chemist, as to how coal and asphaltum are to be distinguished. It is not wholly in their constituent parts that they differ. Coal is composed of certain substances, which also enter into the composition of asphaltum, but in different proportions. Coal differs principally in the quantity of earthy matter which is contained in it, thereby adding to its specific gravity. Asphaltum has very little earthy matter, is lustrous in its color, of partially crystalline appearance; has peculiar surface markings; a large conchoidal fracture, and divisional planes, but no laminations. It has one, two or three per cent of earthy matter, and coal has ten, fifteen, and twenty per cent and upwards, of earthy matter. As regards the chemical analysis, the freer the coal is of earthy matter the nearer it approaches to asphaltum; still the purest coal would not be called asphaltum. The earthy matter is derived from the sedimentary origin of the coal. Earthy matter is one distinguishing feature between asphaltum and coal. I know of no coal containing less than one per cent. of earthy matter, but anthracite is said to be often very pure. I do not know of any anthracite or bituminous coal that contains less than one per cent. of earthy matter—the majority contains much more. I know of no bituminous coal having only two per cent. I do not analyze myself. The specific gravity does not give the exact analytical per cent. of earthy matter, but I can judge of that by the weight of the coal with sufficient accuracy. I obtain the specific gravity by weighing the article in the water and in the air. The Cuban asphaltum occupied certain fissures in the rocks, which fissures had evidently been filled by it while it was in a fluid state. The rocks in Cuba in the vicinity of the fissures containing the asphaltum, con-

sisted of a very numerous series ; those fissures contained little or no shale. I speak from memory having made my observations 15 years ago. There were not sufficient shales as in a coal bed to attract my attention. I don't think from recollection, there was any shale round the Cuban asphaltum. The veins were unaccompanied by fire clay, by fossil vegetation, or by the usual characteristics of coal seams. They enlarged rapidly in descending, increasing from three or four inches at the surface of the main vein to nine feet thick at the depth of about 25 and not exceeding 30 feet. They threw off from the main stem, which was placed somewhat vertically, branches or ramifications. The divisional planes of each vein were arranged about horizontally, that is to say nearly transversely to the vertical position of the vein itself. There was no fire clay, iron stone, limestone, sand stone or sulphurate of iron, in contact with the asphaltum. Those veins presented themselves among the series usually called metamorphic. The metamorphis was caused by heat, and the veins traversed those rocks at various angles ; in all probability at those points and in those directions where while liquid they probably met with least resistance. The asphaltum differed at certain places. Some was more open and less compact, but there was none there to be compared to that in Hillsborough. There is no coal in the West India Islands so far as I could ascertain, except in Jamaica, nor any bituminous shales. I have never experimented upon any variety of asphaltum with iron heated to 600° Fahrenheit. I never applied heated iron to the asphaltum in Albert County, nor did I see any such experiment. If put into the flame of a candle it will melt or liquify. It is one of the characteristics of asphaltum to melt on the application of a certain degree of heat. If a substance were presented to me as being asphaltum which would not melt on the application of iron heated to 600° Fahrenheit, I as a geologist should not believe it to be conclusively asphaltum, at the same time guarding myself from either denying or confirming the opinions of professional chemists. I have found asphaltum in a variety of shales, quite likely among clay shales at Cuba. I never found any fossil vegetable or animal remains among the lines of strata in the vicinity of the asphaltum of Cuba. I am acquainted with the fossil fishes found in the coal formations of this Country and of Europe. The fossil fishes peculiar to the shales of the coal formation are evidently of the age of the coal formation. The fossil fishes are not a distinguishing feature of all coal formations. I have seen the latter most commonly without them. I cannot name the fossil fishes from memory. I gave them to Professor Agassiz or Mr. Redfield, of New York. If fossil fishes were found in the Albert shale they would not influence my opinion. If Dr. Jackson were to describe those fossil fishes, I would rely upon what he would say, unless contradicted by higher professional authority. Dr. Jackson has a very high standing in the United States as a mineralogist, geologist, and agricultural chemist. I am acquainted with the existence of fossil fishes in the old red sand stone. It is generally considered that those fishes do not extend to a much earlier period than that of the old red sand stone. The shales of the Albert mine are full of fossil fishes, and I think they came from below the



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old red sand stone. I cannot describe or name the fishes. I have found no fossil plants in the shales, but have been shewn an obscure specimen, looking like the stem of a terrestrial plant; but whether derived from that locality or not, I cannot decide; also, a small specimen which might or might not be considered a vegetable production. I know the species of fossil plant in the shale accompanying coal measures. The proportion of species differs in the different coal fields. I have no reason to believe that coal is ever formed from animal matter solely, but it may be derived from an occasional admixture of animal and vegetable matters; but I know of no such instance on the continent of America. I should have expected to find some traces of vegetable production in the shales of the Albert mine, for a support for the fishes; but it is probable that the fishes fed on each other, or on some kind of animalculæ, as we find traces of this in the dung or caprolites discovered, and as no traces of plants present themselves. I therefore come to the conclusion, from finding no fossil plants in these shales, that plants did not exist among them at that early epoch. I believe this asphaltum has been forced upwards from lower series of rocks of an older date or epoch. I have seen no igneous rocks in the immediate vicinity of the Albert mines; but injected matter may have proceeded from reservoirs of mineral pitch at a great depth below the surface, whether of transition or primary rocks. I have taken some pains to prove that the old red sand stone still lies above this deposit. I am not aware of the occurrence of seams of bituminous coal in the immediate vicinity, nor did Mr. Foulis offer to point out any such to me, to my recollection. I examined the two branches of Frederick's brook. On that examination I discovered no coal but the usual bituminous shales. I am not aware of the existence of beds of bituminous coal in the vicinity of Frederick's brook, nor in the gray sand stone or grit, in the vicinity of the Albert mines. I know of coal plants being in the gray grit or the conglomerate of the Joggins, and other coal formations in this country. All bituminous coals of the true coal formation are always found in the same associated rocks, with some exceptions in the newer coal deposits, of which the following are the most remarkable. The tertiary or brown coals of the Germans are extensive series along the Pacific shores of North and South America, the Richmond coal fields in Virginia, some coal deposits in North Carolina, some extending from the shores of the Missouri river towards the foot of the Rocky mountains, and northward in the same parallel, apparently to the Arctic sea, and southward towards Texas. The Richmond coal in Virginia is considered to belong to a period posterior to that of the true coal formation, but is still a true coal; it rests upon granite with a thin bed of slate or shale between. All coal formations are not of the same age. Coal does not, to my knowledge, sometimes traverse the strata, unless it be under a violent displacement. The outcropping is always uncertain. The uncertainty may be more or less, according to the nature of the rocks and the influence of the atmosphere. The outcropping may be broken and decomposed in all cases by that influence. I mean by "uncertain," the degree of subsidence. In no case by subsidence, or atmospheric agency, will the outcropping of coal cross the stratifi-

cation ; and invariably the coal will hold the same parallel relation to the rock above it and below it. In the case of subsidence and atmospheric influence, it never can be transverse to strata by which it is enclosed. In the old red sand stone, or in the sand stone that frequently underlies the coal measures, marine shells are very abundant in some of its beds ; some portions of that stone are without them. I have found no marine shells in the old red sand stone. I have examined in Albert. I have carefully examined the strata in the vicinity of the mine in that county, and in the mine. If I had found any of these shells, or fossil plants and fishes in the mine, or in its immediate vicinity, they would not have changed my opinion, because I considered the vein posterior to the surrounding rocks. If I should be mistaken as to the vein being posterior, the presence of the shells, plants, and fishes, would not change my opinion. I conceive the sand stone of the Albert mine and its vicinity, to be of the old red sand stone epoch, because it resembles it in its usual characteristics, and occupies the position in which the old red sand stone is generally observed. Those characteristics are the presence of large beds of conglomerates, red and grey sand stones, and red marls and slates. I discovered that conglomerate through the whole country, the nearest to the mine being about a quarter of a mile from it. The bituminous shales appear to be rising from beneath the conglomerate, and I conceived that the red sand stone conglomerate were newer than those slates ; and the metamorphic slates upon which they also rest, have as regards the metamorphic slates, furnished a large proportion in the form of rounded pebbles, of which the lower red sand stone conglomerate series is largely composed. The red conglomerate was most largely and freshly developed in the cliffs extending along the shore from Mr. Edgitt's. Mr. Edgitt's is distant about three or four miles from the mine. I took the angle of dip of the red sand stone there. I made a sketch of my observations as to the dip and general position, as we passed along. By the rise of the whole mass of strata in a northward direction, I should conclude it to be above the bituminous shales. The angle of rise is, I should say from ten to fifteen degrees. This I state from recollection. In some cases it dips a little to the westward. For this reason, and from the rise of the strata at the mine and its vicinity, I conclude that it overlies the bituminous shales. I do not know the geological age and position of the gypsum in Albert county, and therefore I cannot describe its position. Bituminous coal does not contain uniform portions of bituminous matter, and scarcely two seams are to be found alike. I do not know of my own knowledge, that bituminous matter in coal has been thoroughly investigated. I am not aware from any tables compiled by me, or from any other source, that in Scotland there exists coal containing ten per cent. more bitumen than the material found in Albert mine. I am not aware, from my own memory, that there exists coal in Scotland containing seventy per cent. of bitumen. A book called *Statistics of Coal*, and presented to me, and marked by the examiner as commissioner with his initials, was written by me. All the statements and tables made and found in that book, I believe to be authentic, and I received them on the authority of the analysers themselves. All the principles con-

tained in the introduction to that book, I believe to be correct. From these principles and my own experience, I arrive at the opinions already expressed by me, with reference to the Albert mine. The opinions advanced by me in that book, are entitled to as much credit as any advanced by me at this examination. I do not know that bituminous matter in coal is soluble in oil of turpentine, or oil of naphtha, it being a chemical question, and I wishing to express no chemical opinion. Neither do I know that asphaltum is soluble in naphtha, or oil of turpentine, but it will melt at a certain degree of heat. I do not know that asphaltum, when melted by the application of heat, will pour from one vessel into another. I do not know the origin of asphaltum, and that must be determined by chemists, and even then not by chemists alone, because the origin must still remain in its original obscurity. There are various opinions as to the origin of asphaltum, but its sources are deeply seated and cannot be investigated readily. There are various conflicting opinions as to its being derived from organic or inorganic matter—it being matter at present wholly unsettled. It is the province of the chemist and geologist to decide upon the nature of the substances found in the strata. The labors of the chemist and geologist mutually throw light upon the results arrived at by each on their mutual observations. The chemist tests and analyses the substances, and the geologist ends the investigation by examining the physical and geological phenomena that present themselves. Organic matter has been discovered below the granite, excepting in cases where the granite has been obtruded in veins or dykes through late formations, as in the case of trap ligneous rocks; in which cases organic matter may be found below. If a man possessed a thorough knowledge of chemistry and geology his opinion would have greater weight than that of one possessing a knowledge of geology only, and the same *vice versa*. I cannot describe the difference in the analytical proportions of bitumen and coal from my own experiments. I distinguish between them by their physical characters. The laminations in the case of the coal, its compactness and apparent purity. Mineral pitch and bitumen are synonymous. Bituminous coal and coal are synonymous terms; except by inadvertency or referring to a popular phraseology, they will be synonymous in their general application and popular sense of the word. If the purest piece of hard asphaltum and one of the purest pieces of coal were handed to me I would distinguish them by the following means: by the presence of lamination or planes of deposit in the usual case of bituminous coal, and by their respective structure and fracture, and by their specific gravity as a general rule. I know of no cannel coal without original laminations being capable of detection, and of no other coal. In the case of anthracite which has been deprived of its bitumen, the lamination may still be traced. I cannot define the quantity of fixed carbon, volatile and bituminous matter in coal, from experiments performed by myself. I know of no distinction between bitumen and asphaltum but its compactness when in a solid form. Asphaltum is always hard; bitumen is either liquid or solid; and when speaking of asphaltum the solid bitumen is generally understood; and equally known by the name of mineral pitch; or in other words, asphaltum is

a mineral combustible. The word mineral includes asphaltum. [The following question was put to witness. "Is not asphaltum found in coal mines, and even in masses in the interior of fossil plants?" To which witness replies. "Solid bitumen is found in coal strata, and in the interior of some fossil plants, but more frequently in the exterior."] In the case put it is not designated asphaltum, although a chemist might come to the conclusion that they would be one and the same thing. It is a matter by no means determined as to the cause of the bituminization of plants in the mines. The process of bituminization converts the vegetable substances into the state of coal and then it receives the designation of coal. The plant charged with solid bitumen receives the ordinary appellation of coal. In the Albert mines I discovered no soft liquid or brown oily substance or springs of those substances. At Ayers' farm in the corresponding bituminous shales on the east side of the Petitcodiac river, those substances were seen by me. I searched for such substances in the mine and its vicinity, but could find none nearer than at Ayers'. At Cuba, in the vicinity of the asphaltum mines, I discovered these substances in numerous springs, and also in the neighboring metamorphic rocks. I know of no instance of an asphaltum mine where those springs do not occur in the neighborhood, except in the case of the Albert mine. I gave Mr. Legal a written opinion stating that the substance in question appeared to me to be asphaltum, but I declined to be responsible for any opinion unless I had geological data by personal or reliable investigation to confirm it. I formed such opinion from the appearance of the substance, and from its comparison with the specimens I myself collected from Cuba. At my first visit to the mine I spent not less than two hours in the mine. I should have been longer in the mine if I had taken admeasurements as I went, but I hastened my visit fearful that it might have been considered intrusive, although I was invited to visit the mine by Mr. Cairns, who had charge of the mine. I was in the mine in company with Doctors Jackson and Robb, and the others, on the second visit, about four hours, or a sufficient time to investigate the principal points, which we wished to determine conjointly. We went into five levels, the others were not in operation; and it was said by Mr. Brown that the veins in those levels were worked or wedged out. We waited at the mouth of level No. 7, until Mr. Brown announced that it was safe for us to proceed—he having gone in to inspect the level with a safety lamp while we waited. This was on the second visit. Mr. Brown took a safety lamp with him, as he was apprehensive, as slight explosions had frequently taken place. Upon a match being lit and applied to a small aperture in the mine a slight flash was produced by a blower. If this blower and explosion had been upon a large scale it would have been dangerous. I know of no asphaltum mine where blowers exist except at Hillsborough, for the reason that the largest workings at Cuba, at the time of my visit were open to the atmosphere and lights were not used. Blowlers might occur in a covered asphaltum mine. The Albert mine is the only one with which I am familiar where the inflammable air proceeds from blowlers in the mine. I think I see sufficient evidence to justify me in coming to the conclusion, that the rocks composing the cliff

below Edgitt's, in Hillsborough, belong to the old red sand stone formation. I discovered at the foot of the cliff, substances of a ligneous structure, which had probably fallen from some bed in the group, and which are no doubt of vegetable origin. The fossil plants discovered at the cliff below Edgitt's, are similar to those which are not unfrequently found in considerable quantities in some part of the old red sand stone series. I come to the conclusion from the presence of the conglomerate, that the subordinate sand stones also existed beneath. This conglomerate presented itself at Robert M. Steves' clearing. I have seen no calamites or fossil plants in those sand stones. I consider the lepidodendron characteristic of the coal measures; but I have seen it also in old red sand stone; but ninety nine times in one hundred in the coal measures; for trace very distinctly in the old red sand stone occasional lepidodendra, and various other coal plants, but very rarely in sufficient abundance to constitute a coal seam. I am not aware of the existence of any lepidodendra in the shales of the Albert mine, nor of flag like leaves. If the lepidodendra and the flag like leaves had been discovered abundantly in the shale, I should have in all probability ascribed them to the usual coal vegetation, they being the usual coal plants, and characteristic of the coal formation. I have never seen asphaltum in argillaceous shales, with the exception of the case in Albert. In the other cases that I have mentioned, the asphaltum veins are accompanied by and traverse more solid rocks. Coal shales generally, are of various colors—gray, dark, blue and black—in proximity to the seams. As you recede from the principal depository of bitumenized vegetation, the shales commonly assumed a lighter color; such as green, brown, gray, and their varieties. The same species of plants are found in the sand stones, shales, clays, and even in the coal itself. The bituminous shales dipped conformably, or as nearly as we could determine, to the sand stones and conglomerates, and passed underneath them. The dip of the sand stone at Mariner Steves' was to the north west, 40°, strike north east and south west. At Mariner Steves' we were told that we were a couple of miles from the mine. Rising up the slope of the Caledonia mountain, after leaving Baisely's farm, the same black, contorted, highly bituminous slate continues for one eighth of a mile. From beneath this black bituminous slate, rises a greenish metamorphic rock or indurated slate, which had an east and west course and a north dip, strictly conformable with the bituminous slate. We had just passed the dip varying from forty to fifty degrees towards the north. We then gradually descended to the summit of the Caledonia mountain, where similar metamorphic rock, but somewhat more talcose prevailed. Its course was north, 60° east; its dip north, 30° west, at an angle from 50 to 54. We considered on inspection of the rock that it was the principal source of the rounded pebbles we had seen in the old red sand stone conglomerate at the cliffs, at Edgitt's. The reason why I did not consider that the bituminous contorted slate in Baisely's farm corresponded to those at the Hillsborough mine, was that those at the former were blacker in color, more charged with bitumen in their lamina, more contorted, more difficult of fracture, excessively tough and hard; and in the slates which we investigated,

we perceived no fossil fishes. I do not consider it essential, that in the existing strata of coal fields the beds should be horizontal or nearly so. I am aware that coal often occurs in highly inclined, and even overturned strata; and in such cases the shales are tortuous and frequently much broken. There are often in such disturbed and highly inclined strata detached masses of strata or shale, occurring at various angles, and designated by the miners as 'horses,' which for a while interrupt the regularity and continuity of the coal seam. I saw such horses in the Albert mine, which I mainly ascribed to the ramifications of portions of the main vein. I made a sketch of the principal one; Dr. Robb, Dr. Jackson, and myself, consulted about that sketch. It is very likely I sketched it in Dr. Robb's memorandum book. I discovered that in some instances the veins ran parallel to the bordering strata. The thicker the veins, or in other words, the greater the depth of the tissue that contained the veins, the less probability there would be of thick parallelism. I am not prepared to say that the inclined strata which abut against the vein, are or are not horses. If I saw a vein leaving the main vein, passing around and again rejoining the main vein, I should judge that the enclosed mass would be a horse. From the general confused appearance of the strata at the point called the jog, it is impossible to trace the direction or dip of that portion of the strata, which has not been made visible, from the appearance of the stratification of the rocks on the eastern side of the vein. I infer that the general dip is towards the conglomerate of the old red sand stone, and if continued in the same direction would pass under those conglomerates. I have seen shales in the same vicinity dipping in an opposite direction to the north west stratification of the mine; but I consider those a small and local departure from the general inclination on that side of the main vein. I have not examined the northern boundary of this range, or belt of bituminous shale, within which the vein occurs, sufficiently to enable me to determine whether it is a basin or not. I see nothing to lead me to the conclusion that it is a basin, but rather the reverse. I have examined the green indurated or metamorphic slates of Caledonia mountain, near Baisely's. Starting from near the bridge over Weldon's brook, or the Caledonia road, we continued for seven and a half miles along said road, which brought us to within twelve miles of Edgitt's and ten of the river at the head of Turtle creek, where the formations change. We then left the red and gray sand stone and conglomerate, which there finally cross out and extend upon a belt or range of black bituminous slate, not less than one eighth of a mile wide. The strata of this belt dipped to the north, and ranged east and west. The dip to the north was 45°. I cannot say whether the red and gray sand stone just mentioned, compose part of the range of strata which contains the deposit at Frederick's brook. From my investigation, I inferred that the range at Hillsborough and the slates at Caledonia mountain were separated by the old red sand stone. I commenced the examination to the south of the mine. The bank of Frederick's brook was the limit of my investigation, in a northward and westward direction. I have examined the red and gray sand stone to the east of the mine, as before stated. I have examined the coal series at the Joggins, containing shells and plants usually belonging

to the coal measures. These remains were dissimilar to others observed in the cliffs, near Edgitt's. One coal field, such as that of South Wales, will produce fifty varieties of coal, from the bituminous to the non-bituminous, or anthracite variety. In fact there is an endless variety. I have never known any coal that presented evidence of having been in a state of original liquefaction; nor have I any reason to believe it. Stratified rocks are never otherwise. Those slates which contain the substance under inquiry, come from below the old red sand stone, if all the reasoning I have heretofore given be correct; but if the data prove incorrect, my inferences are also wrong. Sedimentary rocks are always stratified. Red sand stone is always stratified. In coming to the conclusion that this substance is asphaltum, I speak exclusively as a geologist. If the usual plants and fishes of the coal series were to be found in the shale of the Albert mine, it would not change my opinion as to the intrusive character and contents of this vein. If in addition to this, true fire clay, slates, and sand stones, were to be found in immediate contact with this vein, my opinion might receive some modification. The grindstones of Shediac are in close contiguity to or contain a few thin beds of coal which rest upon fire clay. I cannot state whether any grindstone grits in this Province exist lower than the coal formation."

And the said Richard Cowling Taylor being re-examined by Christopher Milner, Esquire, on the part of the plaintiff, further deposed and saith. "Dr. Gesner has invariably preserved that propriety towards me, which left me at liberty to form my own conclusions from the facts I had to investigate. The conduct of Dr. Gesner was such as to lead me to form my own opinions, and with that impression he did not accompany me to the mines or in any of my explorations in that part of the country. Asphaltum is classed in the books on mineralogy, as a mineral combustible; the other minerals consist of the earthy mineral, such as the earths containing any mineral substance that may be contained in them. Next the metalliferous: such as copper, lead, tin, silver, gold, &c. I am not prepared to give a definition of the term 'mineral,' further than in the classification already given, viz.: earth, metallic ores, and mineral combustibles. The common phraseology in Havanna and Cuba in addressing persons who spoke English, respecting the chappapote or asphaltum of Cuba, was to denominate it by the word 'coal,' for never having seen coal, and as it does not exist in the Island, the inhabitants concluded that every black inflammable substance must necessarily be coal. In conversation, speaking of the substance as coal, the word 'coal' was inadvertently thus used in common with the terms chappapote or asphaltum. I did not intend by my work to convey the idea that the substance called chappapote was a coal or a variety of coal. The 'horses' as they are termed, which occur in the Albert mine, are decidedly the result of the ramifications of the veins of the mineral substance passing from and returning to the main vein, thereby inclosing considerable masses of unprofitable material, which has to be worked out at considerable expense. The 'horse' in the working of coal seams, means a mass of disturbed material, which by its interposition has for a period of greater or less extent interrupted the

general continuity of the seam. This also is of unprofitable materials, and in carrying on the gang-ways has to be removed at considerable expense. In the one case, that of asphaltum, the 'horse' has been occasioned by the varied direction of the ramifying veins, while in that of coal, it has been occasioned by a locally disturbed or fractured condition of the seam and its accompanying strata. In Hillsborough, the 'horse' is of the kind peculiar to mineral veins. If this injected material of Albert, with all the attendant phenomena, were presented in the interior of a coal formation or any other formation, it would not materially change the views that I have previously expressed.

(Signed) "RICHARD C. TAYLOR."

Sworn to and taken before me, at Dorchester, County of Westmorland, this sixth day of June, 1851. (Signed) A. E. BOTSFORD,

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*B.*

Deposition of a witness, produced, sworn, and examined, on the twenty second day of August, in the year of our Lord one thousand eight hundred and fifty one, at the Court House in Dorchester, in the County of Westmorland, in the Province of New Brunswick, in pursuance and by virtue of an order made by the Honorable George Frederick Street, one of Her Majesty's Justices of the Supreme Court of Judicature of the Province of New Brunswick, to me, Thomas S. Sayre, Esquire, directed for the examination of a witness, in a cause depending and now at issue in the said Court, between Abraham Gesner, plaintiff, and William Cairns, defendant, on the part and behalf of the said defendant.

James Gates Percival, of New Haven, in the State of Connecticut, United States of America, produced, sworn, and examined, on the part and behalf of the said defendant, deposeth and saith as follows :

"My name is James Gates Percival. I am a Doctor of medicine, of New Haven, Connecticut. I was employed in the geological survey of the State of Connecticut, and prepared a report thereon which was published in 1841. I have since been employed in exploring different mineral localities, in the same and adjoining States. I am not acquainted with the plaintiff in this cause. I have visited the Albert mine at Hillsborough in this Province, a few weeks since, in company with Mr. Archibald. I did not visit the Albert mine at the instance of Mr. Archibald, nor in his employment. My object in visiting the mine, was to inspect it professionally. I had no interest whatever in the result of my examination of it. I made a written report of my examination to Mr. Archibald. I visited the Albion mine in Pictou, Nova Scotia, after my first visit to the Albert mine. Since that visit, I have been at the Albert mine, viz : from Thursday of last week till yesterday, exploring the mine and adjacent country. The rock immediately accompanying the mine is a shale, generally calcareous and bituminous ; but there are some beds apparently argillaceous. These beds when on the surface, and in some instances in the mine itself, are decomposed into a soft clay. The shales contain



bands and nodules of iron stone and lime stone; they contain also seams of iron pyrites, and disseminated iron pyrites in points near to and more remote from the mine. I discovered beds of blue limestone and fine grained gray sand stone in the shales; near the mine I saw none of those last mentioned stones. I mean in immediate connexion with the mine. The shales contain fossil fishes, fishes teeth, and fishes scales, abundant in the neighbourhood of the mine, and in an excavation made by Mr. Foulis at some distance in the line of direction of the mine. They contain at both these situations, rarer instances of distinct remains of fossil plants; and I have also observed a few instances of charcoal lignite in the same situation. The shale I have described is apparently overlaid on the east and south east towards the Petitcodiac, by a dark brown conglomerate. I did not observe there the exact junction of the rocks. The interval between the two where they appear on the surface, is covered with soil; but the rocks on the surface are seen at no great distance from each other—both with nearly the same moderate dip eastwardly, and the conglomerate on higher ground than the shale. In a ravine three quarters of a mile west of the mine, I observed the junction of the shale and conglomerate. The shale there dips under the conglomerate distinctly. The conglomerate has the same character as at the other locality, east of the mine. From these facts I conclude that at the first locality, east of the mine, the shale underlies the conglomerate. In proceeding east to the Petitcodiac, the conglomerate is overlaid by a friable and decomposable red sand stone, including beds of gray sand stone or grit. From the examination I have made, I conclude that this red sand stone includes the gypsum at the Whitehead, and on the Demoiselle river, near Wilson's. The gypsum at the Whitehead, is underlaid by a blue lime stone, resting on a dark brown conglomerate. That gypsum appears within half a mile of the Petitcodiac, north of William Cairns', the defendant's residence; and the limestone on the hill, immediately adjoining the main road that passes by the defendant's residence. This red sand stone is overlaid by light conglomerate, including beds of gray sand stone. This conglomerate extends to within a mile of the mine, and covers the tops of the hills to the banks of the Petitcodiac, below the coal wharf, that is, south of the wharf. The high bank or cape at the first point south of the wharf is composed of a series of beds corresponding to the order I have mentioned, in receding from the mine. The dip however has varied: in the conglomerate covering the shale it was nearly east, in the bank it is nearly S. E. In the Cape, I first observed at its north point, an underlying bed of dark brown conglomerate; above that, a thick bed of friable red sandstone, with an included thinner bed of gray sandstone; the whole overlaid by a very thick bed of the light brown conglomerate. I have already described, with beds of gray sandstone. The southerly dip causes these rocks successively to sink to a lower level as you proceed south, so that the conglomerate occupies the south point of the cape. In the high bank next south beyond the juncture of the two creeks with the Petitcodiac, I observed an overlying thick bed of the same conglomerate with gray sand stones, underlaid in its northern part by the friable red sand stone above described. That bank is

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north of Bennett's shipyard. From the southerly dip of the rocks, the conglomerate occupies the southern part of the bank. The conglomerate and its gray sandstones in that bank contain large and distinct remains of fossil plants similar to those found in connexion with the Albion mine at Pictou, in the coal formation, and in other localities in the acknowledged coal formation of Nova Scotia, in connexion with small beds of coal. Such plants are jointed calamites, and other reed like plants not distinctly jointed, accompanied with smaller flag like leaves, common to the coal formation. Smaller specimens of the two latter kinds, namely, the reed like plants and flag like leaves, are found in great abundance in very thin layers of gray sand stone included in that conglomerate; the same smaller plants are found in the same abundance in similar thin layers of the same gray sand stone included in the bed of gray sand stone, which I have described as included in the red sand stone of Northern Cape. From these facts I conclude that the whole series of beds in the two banks belong to the coal formation, and that this series of beds correspond to the series of rocks extending to the dark brown conglomerate overlying the shale. Most of the remains of plants in the shale accompanying the mine, correspond to the smaller plants observed in the thin gray shale above mentioned. From these facts I conclude that the shales of the mine belong to the coal formation. Generally, the next formation below the coal is the mountain lime stone, and beneath it the old red sand stone. I observed no rock underlying the shales of the mine in my examination. All the rocks I have observed in the neighborhood of the mine, overlie the shales connected with it. The first appearance on entering the mine at Duffys level is that of a highly inclined bed with parallel walls. The strata on the opposite sides of the mine, when first seen opposite each other, lying nearly conformable, with a large dip to the north west. As I proceeded in that level I observed numerous irregularities, but still the general appearance of a bed remained. The wall on the north west side having with prevailing regularity a dip to the north west; the wall on the south east side shewing occasionally a south east dip, and again returning to the more regular north west dip, as if the irregularity had been caused by local disturbance. In descending into the lower levels of the mine, I observed that the main part of the mine extended quite regularly in a north east and south west direction. I made my particular examinations of that part of the mine at the lowest level, but took a general survey of the upper levels. The mine in descending from Duffys level widens very considerably in the middle portion of its length, but in the lowest level it again contracts considerably, the walls of the two opposite sides approaching each other; that enlargement of the mine not appearing to be the result of rupture from beneath and an anticlinal upheaving of the rocks, but of a bulging in that part the mine, more particularly on the south east side. North of that enlarged portion of the mine it contracts considerably in the direction of its length. The walls are there nearly parallel, with comparatively little irregularities, and nearly vertical. The bed there contracts to two or three feet in width, and continues in the direction of the main body of the mine included between the strata. That part of the bed

has not been excavated. At that point occurs a remarkable fault or shift in the bed, crossing the strata obliquely north westerly. By that fault the substance of the bed passes first through a narrow fissure, which gradually widens and turns nearly into its former north east position between the strata. The bed continues in that direction for some distance, and terminates abruptly by an overreaching of the strata, forming a cul-de-sac nearly obliquely towards the south east, and again resuming its former north east direction, with a similar large north west dip, in which direction it has been traced for perhaps twenty feet, with a width of two or three feet in the general direction of the strata. Some obstructions at present existing in the mine have prevented my examining the south west termination of the mine. On the walls of the main portion of the mine, where it appears to follow the general direction of the strata, there appear edges of apparently fractured strata presenting themselves on the walls of the mine, to which the substance of the bed adheres. It appeared to me a remarkable circumstance, that with a few small exceptions, all those edges pointed in the same direction, towards the south; those on the north west, towards the south east; and those on the south east, towards the south west. If these edges had been caused by rupture, the edges on the south east side would correspond to those on the north west side, that is, if the edges on the south east presented south west; those on the north west ought to present north east; but I did not in any instance, observe any such correspondence. If the walls had been pushed apart in a longitudinal direction, we might expect to find these correspondences at some distances from each other; but this distance ought to be in proportion to the extent of the fault in the mine; but in tracing the opposite walls to a much greater distance, I could not observe any such correspondence. I observed that where the edges of the strata presented themselves to the mine, and the strata of course appeared to enter the walls, the strata next south west forming the walls of the mine, appeared to have been protruded against the out-turned strata which entered the walls of the mine. The ends of the strata thus protruded, were obviously bent in towards the mine. The out-turned were seen soon by an abrupt flexure to return again into the direction of the walls of the mine; the whole appearing to indicate that the walls were broken across vertically, and that that part of the strata towards the north east was turned out towards the mine, and that part towards the south west was protruded against those on out-turned strata by a force acting from that direction. I observed protuberances on the walls of the mine, which were formed by a mere curvature of the strata, as if the strata had been bent or wrinkled by a similar force, which in some cases presented merely a fissure at the point of flame. The curvatures or undulations on the walls were sometimes small and irregular, as if the walls had been wrinkled by a protruding force, acting in a longitudinal direction. All these protuberances and edges of the strata when projecting are called "oncasts" by the miners. Some of them appear to be merely nodules of lime and iron stone, such as occur in the shales of other parts of the formation which lie across the strata or shales, as well as across the substance of the bed. In one instance I observed one of these oncasts to be composed of

the shale filled with minute and irregular veins of calcareous spar. This had been worked out in the walls of the mine, and appeared to be a nodule like the balls found in the conglomerate and sandstone on the banks of the Petitcodiac, and called by the people of the place 'bulls eyes.' Nodules of iron stone are characteristic of true coal formations, and very perfect specimens of them have been found in the shales and walls of the mine. Bands of iron stone are distinctive of coal formations, and are found in the shales and walls of the mine. They are generally found in greater quantities in the floor than in the roof of regular coal beds. I have observed more of them on the south east side of the more regular part of the bed than on the opposite, and from the prevailing north west dip of the bed, the south east side might be considered its floor. I have observed in many instances between the substance of the mine and the thicker shales of the walls, a thin stratum of soft shale breaking in small highly glazed fragments, generally decomposed into a state of soft clay. The whole wall seemed to me to be lined with a fine smooth glazing extending over even the edges of the out-turned strata, and obviously a modification of clay. The facts which I have just stated, namely, the wrinkled and contorted state of the walls, the thin stratum of soft clayey shale and the glazing of the walls, appeared to me to indicate that the bed assumed its present form in a soft aqueous condition, and was not formed by a rupture of indurated rocks and an injection of effused matter. I observed throughout nearly the whole extent of the formation of the shale, the same irregularities and contortions which I observed in the mine, frequent changes in the direction and dip of the strata, and in several instances where those changes in the dip occurred very great contortions in the strata. I have stated that at the north east end of the mine there was a great overarching of the strata, which again turned up into the more regular direction and dip of the mine. In the water level, which is driven for nearly 100 feet in the north west side of the mine towards that part of the mine where this irregularity occurs, there is a similar overarching extending nearly east in the direction of the level, and forming a regular vault to the level. Near the end of the level the strata turns up in a north east direction with a north west dip, corresponding to the arrangement at the east extremity of the mine, which would seem to indicate that that irregularity in the mine extended thus far in the shale. In one instance I observed in the bed of Frederick's brook, a band of thick even shale crossing the bed of the brook, and intersecting nearly at right angles a band of thin undulating shale, in a manner similar to the passage of the substance of the mine, across the strata at the vault. I have observed similar appearances in bands of lime stone crossing the shale. These facts seem to indicate that the irregularities of the mine find their parallel in the irregularities of the shale, and that the whole formation was subjected to a common disturbance. The facts which I observed, particularly in the oncasts of the mine, indicating a protruding force in a longitudinal direction from the south west, and the overarching from the west in the north east extremity of the mine, and in the water level, connected with the change in the dip of the strata east of the mine, from east to S. S. E., appeared to

indicate that the disturbing force acted from the south west, accompanied with a contortion to the east, and not by an anticlinal rupture from beneath. My conclusion is that it is a bed of deposit, and not an injected mass; that the irregularities of the bed are caused by the change from the original horizontal position of the deposit, to a nearly vertical one, accompanied by the disturbing forces just mentioned; that these disturbances took place when the shales were in the soft aqueous condition, like beds of clay; and that in this manner the peculiar appearance of the walls of the mine can only be accounted for. The substance of this mine is similar in its external character to cannel coal and jet, which form a class of highly bituminous coals, in which the original structure, found in common bituminous coals, is nearly or quite obliterated, and which have been considered by some eminent geologists to have been originally in a fluid or semi-fluid state; and which like all fused or liquid substances in cooling or hardening, are divided by pointed seams or planes of cleavage, conformable to the including walls. Where the walls are perpendicular, such a bed would be crossed by two sets of planes—one horizontal, the other vertical; and by a third set vertical and parallel to the walls; thus dividing the substance into regular solids. Where the walls are inclined or irregular, these cleavages would be correspondingly inclined and irregular. In a large bed the central portion of the mass would be divided into larger regular or irregular solids, according to the position of the bed. The lateral portions of the bed adjoining the walls would be divided into smaller solids, of a similar character. In a small bed or vein, the whole mass would be divided into such small solids throughout. These facts are observed in trap dykes, which are generally considered to have been originally effused matter; and I observed the same facts to prevail in every part of the mine I examined. In the central portion of the main part of the mine, where the walls have the most regularity and are most nearly vertical, the surfaces of the solids in the centre of the bed appear to be nearly horizontal, crossed by the planes of cleavage, which are also called divisional planes, nearly vertical. One might conclude from this alone, that this was the general arrangement of the divisional planes; that as the walls frequently deviate from the perpendicular, that the divisional planes were unconformable to them; but after a particular examination, I can state that the divisional planes always conform to the position of the walls, inclined or irregular, when they are so. These divisional planes have no relation to the original structure of the substance, but are only the effect of hardening. I have observed in the central part of the bed, where the planes are most regular and horizontal, when observed in a strong light, delicate lines traversing the substance in the longitudinal direction of the bed, perhaps indicating the original lamination of the substance parallel to the walls, as in common coal beds. I have applied the tests of heat and combustion, which are generally considered as distinguishing coal and asphaltum. I have subjected to those tests the two most distinct varieties of the mine. *That* breaking in large fragments, and *that* divided into laminations and small fragments, called structural coal at the mine. Applied to the flame of a candle they do not melt, but crack and flake off like coal.

I have applied specimens of Egyptian and Trinidad asphaltum to the flame of a candle : they readily melt and drop. I placed specimens of the two varieties of the mine above mentioned on red hot iron : they burn with a full flame, but swell and jet out like the more bituminous coals, and leave a bulky coke or cinders. I have applied the specimens of the asphaltum above mentioned to red hot iron : they burn with flame rather fuller than that of the substance of the mine—melt and run, and leave behind a flat button, chiefly composed of earthy impurities. Applied to an iron heated just below ignition, the asphaltums melt and run like wax—the varieties of the mine separate into flakes, and slightly soften like the more bituminous coals. I conclude that the substance in question belongs to the coal formation, and is itself a modification of coal and not an asphaltum. I have observed in peat bogs, lying under the body of peat on the earthy bottom, in several instances, in Connecticut, a thin stratum of a substance, having the external characters of the substance in question highly bituminous, and burning in a manner similar to it. It is stated that a similar substance is found under the same circumstances in the peat bogs of Ireland.”

[The following six questions are here put to the witness, and objected to by Mr. Milner : “ Do you know Dr. Jackson of Boston, in the United States ? What is his profession, and standing in it ? *Answer.* I know him but slightly personally, but I know him well by reputation : he is considered one of the most distinguished geologists and chemists in the United States : he has been employed in surveying, as a geologist, the States of Maine, New Hampshire, and Rhode Island, and has been “ President of the American Scientific Association,” which includes the most eminent men of science in the United States. Do you know Dr. Ure of London ? What is his profession and standing in it ? *Answer.* I know Dr. Ure only by reputation : he is universally known throughout the scientific world as an eminent chemist.”]

“ The odour of this substance when tested as above, is different from that of asphaltum : it has the common odour of bituminous coal. Coal is a mineral, and is so described in all books of mineralogy. Asphaltum and gypsum are also minerals, and so described. Pure gypsum is a chemical as well as a mineral species.”

Cross-examined by Christopher Milner, Esquire, on the part of the plaintiff. “ I have visited the Albion mine in Nova Scotia. I am personally acquainted with no others. I was at that mine one day. My knowledge of coal mines is from general reading, not from personal knowledge. My geological surveys in the United States were not in connexion with coal fields, but the secondary formation in Connecticut has been considered a coal formation, and searches have there been made for coal. I have explored that formation minutely, and the localities where those searches have been made. I have not visited places where asphaltum is found, and unless the deposit in Hillsborough is asphaltum, I have never seen asphaltum in the earth. My opinions of asphaltum are founded on reading. I have formed none of my own except from reading, nor have I otherwise formed my opinion of coal except from recent investigations. What is your opinion of the origin and geology of asphaltum ? I decline to answer

the question. Coal is a deposit connected with sedimentary formations, with organic, animal, and vegetable remains. My opinion is that it is chiefly formed from vegetable remains. Coal has never to my personal knowledge been found in a fluid or semi-fluid state. Coal fields when they lie regularly and have not been disturbed, lie parallel to the bordering strata. I have observed only the Albion mine and the mine in question. The Albion mine is an undisturbed coal mine so far as I have examined it. The walls and the seams are even and conformable. I have stated already that in the Albert mine the seams of the coal correspond to the surrounding strata. I know of no case where coal is an original injected mass. It is a sedimentary deposit in its undisturbed state. I know of no case where coal after being disturbed becomes an injected mass. Coal seams when regular are of uniform thickness to a large extent, but there are numerous instances where they are irregular, varying in thickness in some instances from the irregularity of the surfaces on which they are deposited. I have never known from personal observation of a coal seam expanding from one to fourteen feet in thickness, at a depth of fifty feet. Coal seams do not usually stand perpendicular in the earth, but in the anthracite coal fields of Pennsylvania many of them are nearly vertical. The beds of the anthracite coal fields of Pennsylvania are generally highly inclined. There are instances of the walls of coal fields diverging from each other, leaving the coal like a wedge in the earth. Does the course or strike of a coal field usually vary much in the course of three or four hundred yards? It may vary in that distance in a very disturbed coal field. Are not the divisional planes or lines of cleavage of coal always parallel or nearly so to the bordering strata? Yes. Are not the divisional planes of bituminous coal marked by thin layers of mineral carbon which give smut when rubbed? So far as I have observed from specimens, it does not occur in cannel coal and jet, but in ordinary coals it does. What do the rocks containing coal seams usually yield by dry distillation? I have made no experiments upon them, and therefore decline answering the question. Will coal shales usually burn or answer for fuel? I have made no experiments upon them, and therefore decline answering the question. Do not beds both above and below coal fields usually abound in stigmara and numerous other fossil plants? Usually in the coal fields of the coal formation so called. Does not every coal field have its stigmara bed? I have observed stigmara at Pictou. I decline answering the question generally. Are not fossil vegetables very abundant in the vicinity of coal seams, and touching the coal? I decline answering the question. Does not coal itself contain fossil plants and leaves of plants? Not every variety of coal. Cannel coal, jet, and anthracite, contain no distinct fossil plants and leaves. There are some kinds of coal in which the vegetable structure cannot be discovered by the naked eye. If they cannot be detected by the naked eye, can they by the microscope? I decline answering the question. I will not undertake to swear but that the vegetable texture may be detected either by the eye or microscope in all sorts of coal. Is not the smut or mineral carbon in coal derived from the carbonized vegetable matter in the coal? I decline answering the question. Is

not the bed of a coal seam usually different in its lithological character from the roof? I decline answering the question generally, but in the Albion mine there is a difference—the floor there contains lime and iron stone which I did not observe in the roof. How are metallic veins and trap dykes supposed to have been formed? Trap dykes are generally supposed to have been injected from beneath, but there is a difference of opinion as regards the metallic veins. Are not the strata usually disturbed in the neighborhood of trap dykes? I have found them disturbed and not disturbed. Do not metallic veins run and ramify in all directions, and does coal ever occur in this manner? I decline answering, as I cannot do so from personal observation. Do you know of any particular rule by which metallic veins may be traced? I decline answering the question as a general one. Are coal seams ever found in veins in the manner of copper loads or trap dykes? I cannot state it from personal observation. Do coal seams ever give or send off lateral ramifications or veins, or smaller seams that taper off to nothing? I decline answering, it being a general question. Can a sedimentary deposit ever occur in the manner of copper loads or trap dykes? I decline answering it generally. The articles now presented to me have the general external characteristics of the coal of the Albert mine, and on being submitted to the test last evening, they acted in manner similar to it, and not like the asphaltums. There are some slight differences between these specimens, and there are also some differences between different specimens of the mine. Can you point out any difference between that specimen [handing witness one] and corresponding specimens in the mine? I decline to answer the question. Between the other three specimens there are some slight differences, but I would not from those differences form any opinion as to their identity. From the inspection you have made of the mine, and from experiments upon the material taken therefrom, do you believe the specimens which you have examined and which are now produced are from the same mine? I decline to answer the question, being matter of mere belief. Do you believe them to be identical in character? The articles now presented to me have the general external characteristics of the coal of the Albert mine, and on being submitted to the test last evening they acted in a manner similar to it, and not like the asphaltums. Do you peremptorily refuse to give your opinion as to the identity of the specimens produced with the substance in the Albert mine? Yes. How does anthracite differ from bituminous coal? By not containing bitumen, and by its greater hardness. Of what is bituminous coal composed? That being a chemical question, I decline to answer it. Of what is asphaltum composed? That being a chemical question, I decline to answer it. What is the difference between coal and asphaltum? That being a chemical question, I decline to answer it. How do you distinguish coal from asphaltum? As far as I employed the tests before mentioned I will answer. Asphaltum by heat melts readily. Coal does not. I am not acquainted with any coals that melt and run, but with some that soften. Bituminous coals soften. Do you know of any coal that dissolves in oil by the application of heat? Not from personal experience. Have you ever heard of any such coals? I have not. If a substance were pre-



sented to you that did dissolve in oil by the application of heat, would you consider it coal or asphaltum? Being a chemical question, I decline answering it. Have you not already given an opinion that the substance of the Albert mine is coal, from chemical tests applied by you? I gave an opinion from tests already stated in my evidence, and from no other. If you had applied the additional test of dissolving the specimens you tried in oil by the application of heat, and succeeded in dissolving them, would your opinion be the same as at present? I decline answering that, as a chemical question. If you were to see those specimens now before you melted in oil, what would you consider them to be? I decline answering that, as a chemical question. Do you peremptorily refuse to answer to which, coal or asphaltum, you would consider them to belong if dissolved in oil? I peremptorily refuse to answer a chemical question. Is whether a substance is coal or asphaltum a geological or a chemical question? It may be a chemical question. Are you prepared to decide whether the substances presented to you here are coal or asphaltum? I decline answering except so far as I have already answered. You having already answered to the question before the last that the question may be a chemical one, how can you undertake to say that the substance in the Albert mine is coal? I do not undertake to say it is coal from chemical characters, further than I have stated. Then your opinion of that substance being coal, is formed from its chemical characters? In the last answer I stated that I did not undertake to decide from its chemical characters, further than I have stated. Then as far as you have stated, your opinion is formed on its chemical characters? Not from those alone. If not from those alone, from what else was your opinion formed? From the geological appearance of the mine and adjoining country. Did you not yesterday state that you had no personal knowledge of any coal mine whatever, except at the Albion mine at Pictou? I have no knowledge of any other mines from personal examination. Your personal knowledge then of coal mines is confined solely to your visit of one day to the Albion mine? Yes, from personal examination. Does the mine at Hillsborough agree in its geological character with the Albion mine? It does not precisely—the Albion mine is a regular coal bed—the other disturbed. State the points in which they coincide in character and position? They both belong to the proper coal formation, and both lie in beds between walls. State the points of difference between the two? The walls of the Albion mine are quite regularly parallel; in Hillsborough the parallelism is disturbed. I observed no fault in the Albion mine; there is a fault in the Hillsborough mine. In the Albion mine the walls generally run parallel, or nearly so. In Hillsborough I observed them occasionally parallel, or nearly so; the parallelism is disturbed in other places. In Pictou I did not observe coal crossing the strata. I observed it as the fault in Hillsborough, apparently crossing the strata. I did not observe small veins or seams crossing the strata in the Albion mine. In the Hillsborough mine I observed small veins of coal traversing the shales, not at all angles, but in directions apparently corresponding with the arrangement I have described in my evidence. I have seen small seams of the substance of the Hillsborough mine traversing the adjoin-

ing shales, in the manner I have stated in my last answer. Have you seen in any of the adjoining rocks of the Albert mine, fissures traversing them at various angles, filled with the substance of the mine? I have seen fissures in the rocks adjoining the bed, filled by the substance of the bed, traversing them at different angles in the manner I have stated in the preceding answer. I observed when a stratum appeared with its edge towards the bed, as if fractured across and turned out, and then turning again in the direction of the bed, seams passing in behind such out-turned rock, first at an angle with the bed, and then resuming with the strata itself a general direction conformable with the bed. Have you not seen fractures in the lime stone in the sides of the mine filled with injected material, similar to that of the mine? There are bands of lime stone, or lime and iron stone in the walls of the mine; these are affected by the disturbance of the mine in the same manner as the other rocks which form the walls of the mine; but I have not taken special note in observing the seams of the substance traversing the rocks, of their particular connexion with those bands of lime stone, or lime and iron stone. What is your opinion of the manner in which those rocks were so filled with that material? On that point I have reserved my opinion in my own mind, and have not stated it in my evidence. I have not formed an opinion on that point. Did you see in the Albion mine coal occurring in small seams in a similar manner? I did not observe any. Do you know of any such instance? Not from personal examinations of any other localities than the Albert mine. Do you know as a geologist of such small veins ramifying from the main seam in different directions in any coal mine; and if so, state at what place or places? From personal observation I know of none in any other place than the Albert mine. Do not the strata on each side of the Albert mine dip at different angles somewhat in the manner of a steep anticlinal axis? They do not appear so to me. How wide is the mine at the top? I have stated that the mine is wider below than at the top, and still lower is narrower again; but I have not taken admeasurements. Then you state positively that they do not form angles in the manner of a steep anticlinal axis? I state positively that they do not appear to me to form angles in the manner of a steep anticlinal axis. Do they form angles in any other manner? In my evidence I have described the mode in which the walls appear to deviate from each other, and to that I refer. What is the dip of the strata on the south east side of the mine? I have observed various dips on that side; for any thing further, I refer to my evidence. Does it not dip to the south east, apparently underlying the conglomerate? I have stated in my evidence the manner in which the shale appears to dip under the conglomerate, in a direction east from the mine. Does it not dip to the east or south east? Yes, to the east or south east. Have you observed how the shale on the west side of the mine dips? The dip is very various. What is the general dip of the main portion of the mine into the earth, on the north west side of the mine? There are irregularities in the dip on the north west, as well as on the south east side of the mine; but I think fewer on the north west; the prevailing dip of the main portion of the bed is north west. On the north west

side is the shale nearly perpendicular with the bed? It is less disturbed in dip than on the south east side. Have you not stated that the conglomerate appears to overlie the shales in Hillsborough, and that they dip to the east or south east? I have stated that they appear to underlie the conglomerate, and to dip to the east or south east in a direction east of the mine. Can you state under what rocks that conglomerate lies? In the same direction east of the mine it underlies a red sand stone, as stated in my evidence. What does the red sand stone underlie? It includes gray sand stone, and underlies a light brown conglomerate with beds of gray sand stone. What does the last mentioned rock underlie? I have stated that that is the overlying rock of the series. Have you examined the rock overlying the last mentioned rock? I have not. Are you acquainted with the ridges of conglomerates in Dorchester, extending in the south west to Shepody, and underlying the Cumberland coal field? I have not particularly examined that district. Then you do not know what the general dip of those conglomerates is? I have not particularly examined that district. Then you are not aware that those conglomerates form a divisional line between the Cumberland coal field and the bituminous district in Hillsborough? I have not particularly examined that district. Have you traced the boundaries of the bituminous shale district in Hillsborough, and if so what rocks meet them to the northward? I have traced the boundaries on the east, south east and south west to some extent—not in other directions. Then you are not aware that the bituminous shales overlie metamorphic rocks at New Caledonia, and on granite at a hill in that neighbourhood? I have not examined that neighbourhood. I can state in connexion with this, that rocks of the coal formation with coal plants and their seams of coal, immediately adjoin metamorphic rocks in Londonderry, Nova Scotia. If then these bituminous shales overlie granite and metamorphic rocks, and are overlaid by the conglomerates you have described as existing to the east and south east of the mine, which again are covered by the conglomerates of Dorchester which underlie the Cumberland coal fields, to what geological series do the conglomerates of Hillsborough belong—to the old red sand stone or to the new red sand stone? It does not necessarily follow that they belong to either; they may still belong to the series of the coal formation. If such a state of facts as I have supposed does really exist, to what geological period would you from your examination of them, assign them? I have stated in my last answer that they may still belong to the series of the coal formation, and I have concluded in my evidence that they do belong to the coal formation. Then the relative position which the Hillsborough conglomerates bear to the coal measures of the Joggins, has no influence or bearing upon your opinion? Even if the Dorchester conglomerates were a continuation of the series of conglomerates and sand stones between the mine and the Petitcodiac, and the Dorchester conglomerates underlaid the coal at the Joggins, it would not follow that those conglomerates and the underlying shale of the Albert mine were not members of the coal formation: that could be determined only by examining the fossils of those conglomerates and shales. As I have not traced the rocks from the Albert mine to the Cumberland coal field

I cannot say from my own examination what is the order of their arrangement. If however that arrangement does exist, the Hillsborough conglomerates and shales would belong to the lower members of the coal formation? Yes. Do you know then of any case where the lower member of the coal formation in these Provinces is productive of coal? I know from personal observation of no mine that is worked in the lower member. Did you observe any, and what number of fossil plants in the rocks accompanying the Albert mine; if so, state their number, names, and where you discovered them? I did not observe many; but I observed distinct remains of fossil plants, which resembled remains of fossil plants found in connexion with calamites in the bank of the Petitcodiac; but I have not undertaken the specific determination of the names of the fossil plants. Was your attention particularly directed towards the discovery of those fossil plants? I did not make it the special object of my examination; but it was one among others of the objects of that examination. I examined the shales in different points with reference to fossils and collected such as I found. Did you yourself discover any fossil plants in the interior of the mine, and particularly how many which had not been disturbed except by yourself? I did not look for them in the interior of the mine, but I observed them in shales said to have been thrown out of it, and which exactly resembled the shales observed in the interior of the mine. I observed them in fresh fractures which I made myself. You do not pretend to swear that those shales were actually thrown out of the mine? I do not. They were lying in a heap by the mine. I observed fossil plants in the rock, in the bed of one of the small streams near the mine, which rock had been undisturbed. To what class of rocks does the gypsum of Hillsborough belong? The gypsum of Nova Scotia and New Brunswick has been considered as belonging to the coal formation. Is it not the opinion of geologists—viz., of Sir Charles Lyell and other eminent geologists, that the sand stones and conglomerates which underlie the Cumberland coal fields belong to the old red sand stone formation? I am not aware of that. Do productive coal measures ever occur in the old red sand stone formation? Not to my personal knowledge. Are not those shales at Hillsborough very dissimilar in their lithological characters and fossils to those of the coal measures of Albion mine? They are in some respects dissimilar, but I am not prepared to pronounce upon the degree of dissimilarity. Have you seen any of the petroleum of Hillsborough? I have not. Have you seen any other coal deposits in Hillsborough besides the one worked by William Cairns? I have seen at one locality west of the mine, a thin shale with inter-stratified coal, resembling the thin seams of ordinary coal beds. How wide were the seams? They were very thin. In what direction did they run? They were perfectly inter-stratified as in regular coal. When you first visited the mine, did you explore the whole of it? I decline answering this question. Did you inspect the 7th level on the south west end of the mine on your second visit? I have already said that the mine was so obstructed at or near the pit, that I could not visit the south west part of the mine. Did you visit or inspect the level or gal-

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lery No. 8, on the north east end of the mine? I did. To what part of the mine was your examination directed? To that part extending from the obstructions near the pit to the north east extremity of the mine. For any thing you know to the south west of that obstruction, the strata might form an angle in the manner of an anticlinal axis? I do not know anything from personal observation beyond those obstructions to the south west; but if they did form angles in that manner, it would in my opinion be contrary to the arrangement I observed in the rest of the mine. Did you discover within the mine any of those fossil plants which usually accompany coal seams? The fossil plants which I did discover were not observed within the mine, but in the shales connected with the mine. In what way connected with the mine? Near, or in the immediate vicinity of the mine, as before explained. What do you mean by the substance of the walls of the mine having been in a soft aqueous condition? I mean that they were soft and imbued with water, like beds of wet clay when they assume their present condition. Did you not mean to state that the contents of the seams had been once in a soft aqueous condition? I did not apply that expression to the coal, but to the walls. What expression was it that you did apply to the contents of the bed as having been once in a softer state than at present? I observed that it resembled cannel coal and jet, which have been supposed by some eminent geologists to have been originally in a fluid or semi-fluid state. Did you not mean to infer from that, that this deposit had once been in a fluid or semi-fluid state? I might infer from it that it might have been in that state. Was not that the inference you wished to be drawn in relation to the cause of the present arrangement of the divisional planes of the substance of the bed? Yes, that was the inference. Then your opinion is that that substance has been once in a fluid or semi-fluid state? At least in a soft or semi-fluid state. If that substance had once been in a soft or semi-fluid state, might it not while in that state have been injected into the shales in which it is now found by a force acting longitudinally or otherwise, from some other locality or bed? Judging from the present appearance of the bed, I should think not; but it might have been injected into the fissures formed by such disturbance, and now occupied by the substance of the bed, but not into the whole bed from some other point. What are those appearances from which you judge that the whole mass has not been injected? The appearances particularly which I have detailed in my evidence as observed by me in the main portion of the bed. What are those particular appearances; please state them particularly? That part of my evidence which relates to the appearance of the walls of the main portion of the bed, if referred to, will answer the question. I wish you to restate them? The appearance of a prevailing direction in the main portion of the bed from north east to south west; of a prevailing dip to the north west; the frequent conformable arrangement of the two walls; where the bed is enlaid the appearance of bulging and not of rupture, and the particular arrangement in the out-turned strata or "oncast," so called. Might not all those appearances be presented in a case where the mass was injected by a force sufficient to turn the horizontal strata of the shales to their present highly

inclined position? I should think not without the previous presence of the substance of the bed. In what way could the bed form the bulge of which you speak? It could have been formed by an obstruction before in the longitudinal direction of the mine, and a protruding force in the same direction from behind, in the case of a bed already filled with the substance occupying it. Might not the substance occupying the bed have been injected simultaneously with, or prior to this disturbance of the shales, and thus cause this appearance? I do not think it could have been injected simultaneously; nor do I think that the appearances I have stated could prove any prior injection. In a case where a substance does not present the mechanical sedimentary deposit in that place, I could not say that injection was impossible. Not having seen stigmaria or other coal plants in the interior of the mine, and the substance itself not presenting any vegetable remains, from what do you conclude the substance is formed? I have not formed any opinion as to the precise matter of which it was formed. Does jet belong to the true coal formation of geologists? Jet is considered a coal. I am not prepared to state whether it belongs to the same formation as that of the Albion mine, which is admitted to be of the true coal formation. Is not jet a species of the lignite so known or called? I am not prepared to answer the question. Do not lignites or brown coal belong to the tertiary series, and of more recent formation than the group of strata, known by the general name of the coal formation? They belong to recent formations later than the coal formation. From the geological position of this bed can it be jet? I decline answering the question. In your opinion is it jet? I decline answering the question. Do you peremptorily decline to express an opinion as to whether it is jet or not? I decline giving an opinion. Are you acquainted with the old red sand stone group of rocks? Not from personal examination. Are not clay iron stone balls frequently found in the old red sand stone group? I have not personally examined that group. Did you ever see coal melted, and in the form of a paste? I did not. Have you ever seen or heard of coals being dissolved and made into a varnish? I have never seen it, and I decline answering further, as it is a chemical question. Did you ever see coal made into printer's ink? I decline answering that question for the same reason. If you saw the Hillsborough deposit in the form of printer's ink or varnish, would you consider it coal or not? I decline to answer, being a chemical question. You have stated in your evidence that you tested the Hillsborough material by heat, and by comparison with two specimens of asphaltum; if the Hillsborough material had melted as quickly as the asphaltum, and produced the same results, would you not have called it asphaltum also? I decline answering such a question as that. Do you peremptorily decline to answer it? I decline answering it.

Re-examined by Bliss Botsford, Esquire, on the part of the defendant.

What did you mean in your examination in chief by your expression "a modification in coal?" [Mr. Milner objects to the question as improper to be put.] I mean a variety of coal. You were asked about visiting the 7th level, and you answered that the mine was

obstructed ; how was it obstructed ? What I observed was a fall in from Duffys slope ; I observed no further obstructions. Will you give your reasons for declining to answer the following question asked you on your cross-examination ? "When you first visited the mine did you explore the whole of it ?" [Mr. Milner objects to the question as improper to be put.] From personal considerations connected with that visit. When to several questions put to you on the cross-examination, you answered "I decline to answer," do you mean to convey the idea that you have personal knowledge of the subjects asked, and chose to withhold the information ? [Mr. Milner objects to the question as being improper to be put.] I do not mean to convey that idea. Do you know of any coal being found in the granite ? In parts of the Richmond coal field the coal lies directly on granite. You have been asked if you know whether coal seams generally preserve a uniform thickness. Do you know of any coal beds which are thicker in some parts than in others, and which thin and run out ? Not from my own knowledge, but such beds are described. [Mr. Milner objects to the relevancy of the answer, except in so far as the witnesses knowledge is derived from personal observations.]

(Signed)

JAMES GATES PERCIVAL.

