

MINE SURVEYING

Interesting Paper Read Before the School of Mines by
R. E. PALMER

The subject upon which I promised to read a paper tonight is one which in its technical points is of most interest to the surveyor or his student, but I shall endeavor to so divide the headings that it will be of interest to all. I will also endeavor to give prominence to points which may at some time be of use to managers, superintendents, foremen and all mining men.

It has been stated, and truly so, that the most successful managers and superintendents are and have been those who make a point of keeping their surveys up to date. It may be said that this is the argument from the point of view of the surveyor, but I think and hope that you shall be able to show and convince, all mining men that this is true from every standpoint. I heard it said not very long ago by one of the best and most successful mining engineers and managers in the United States that there is practically very little difficulty in getting the ore out of the ground when it is once found, but what was wanted everywhere and by all men who were most sought after were those who could, with the least amount of dead work, find the ore, and that this could not be done successfully unless the surveys were accurately done and kept up to date. The question of locating ledges and doing the preliminary prospecting on a piece of ground is, of course, the work of the miner or prospector. After this has been done, a subsequent development work accomplished to define the ledge, ore chutes, and perhaps a few dikes, breaks or faults, which may be located on the surface or very near the surface, then the work of the surveyor begins.

His work is to accurately locate and map out all the work which has been done, all the exposures, trends, strikes, and any other features, either physical or topographical, which the manager or he himself may be able to determine. We have all seen over and over again in this country the vast amount of money which has been spent in locating ore when a survey often would have shown it all up. In doing this he should leave his field or underground work in such shape that the superintendent can see at a glance which have been left on the ground and which correspond to similar marks on the plans for the purpose of locating all his dikes, faults, breaks, ore, points of taking samples and any geology which is or may differ from that previously met with as he finds them in continuing his work and which may be of immense service in locating ore bodies in the lower levels. I refer to this later on and will ask your indulgence a short time while I speak a little about the technical part of underground surveying.

I think that there is one business or profession in this world which requires more patience, care, accuracy and wearying work more than another—that business is underground surveying—and for that reason I would ask managers to be kindly with the surveyor and give him a good chance even though at times he becomes cranky when doing his work. In mines working in full blast, the surveyor is endeavoring to proceed as fast as possible in order to delay the carmen or general work as short a time as it is absolutely necessary; he has to have all his work done and in order to get everything completed before leaving his point and completed accurately he has no time to think of anything else.

It is the duty of the operator who has some chance of covering over his inaccuracies or in constraining them into something else but mistakes, but the underground surveyor, so far as I have seen, has no way of covering up his mistakes when once made. The slightest error—almost unappreciable at times, in reading the vernier of his instrument either for a horizontal or vertical angle, or the error on his tape line, the disturbance of his points or station marks—the transposing of figures in booking, as for instance, putting down 42.23 instead of 42.31, or many other things too numerous to mention, may throw his survey all out and cost thousands of dollars in having work done, the mistake on which will not be found out until after it is too late to correct, but the surveyor must have an opportunity to go over his work, check it over and see that it is right, even if he delays a small portion of the mine's output for a short time. It will repay his mine in the end.

Instruments—I will not elaborate on this point as it will not be interesting to all, but would suggest to the surveyor getting a new instrument of the following kind: Get one of the very best made, as light as possible consistent with good workmanship, keeping in perfect adjustment, handle it like a baby and let no one else touch it.

It seems natural to human nature that every person, not a surveyor, wishes to look through his instrument, and in nine cases out of ten, will grab hold of the telescope when the surveyor's back is turned and with no intent to do any harm will try and direct the telescope on some object while the plates are changed, and you know the result is the same. Get an instrument of which the tripod has telescope legs and a shifting crosshead, for many places will be met with where it is very difficult to set up at all, while it is very difficult in order to get sights through small openings in stope or shafts it becomes necessary to set up the instrument on either very high or very low down, which is impossible to do unless one can lengthen or shorten the legs of his tripod well. Get an auxiliary telescope with counter-balance to fit either on top or at the side of the regular telescope at will. The auxiliary telescope is absolutely necessary in incline shafts where the incline is over 60 per cent. That is—absolutely necessary in so far as doing rapid and accurate work is concerned, which as I have said before, is the principal success to be obtained in underground surveying. I find that the distance apart of the lines of collimation of both telescopes. Another instrument which I use and which is of immense use and value in the Brunton, but to the surface, not only to the surveyor, but to the superintendent, is the Brunton's Pocket Transit, one of which I have brought with me.

Tapes—I find Keuffel & Esser's Excellent steel tape, 100 feet long, divided into tenths and hundredths, most satisfactory. This, with a ribbon tape, 300 or 400 feet long, divided every five feet, and a spring tape, say six feet long, divided into tenths and hundredths, to be all that is necessary. I believe in measuring all dis-

ances between station points by slope measurement, reading the angle of depression or elevation, the slope and at night calculating the horizontal and vertical distances corresponding thereto. By doing this one can obtain closer results, besides he carries along his level as well as his theodolite, with the necessity of running separate lines of levels.

Marks or Station Points.—The setting of these is most important, and the ground in this camp is so very hard and immovable one is generally able to get them put in places where they are not liable to be disturbed.

I get the foreman to put in plug holes in the roof or back of the workings at every level with hand steels, about three inches deep. Into this he drives a light fitting wooden plug projecting more than one inch or 12 from the hole. After having shown the foreman what is required I depend on him to put in these plug holes as he progresses with his headings, so that when the surveyor at the end of every month or fortnight, goes to make up his surveys he has not to waste his time in digging up old plug holes, but to drill the holes, but can proceed at once.

Into these plugs I use a screw eye, screwed in tight, and with a three-cornered file make a notch or cut in the bottom of the plug, so that the plumb bob will always hang from the center of the notch. These plugs are all numbered and for this purpose I use brass tags about three-quarters of an inch square, with a number stamped upon them and a hole punched in them for a brass nail. When the assistant, and one is all that is ordinarily necessary, has put in his screw eye, filed the mark and numbered the plug, the surveyor is ready to go to work.

These plugs are shown on the plans or maps with numbers corresponding to those on the works, and are of enormous value for the manager, superintendent, sampler or geologist in locating the ledge, or to the surveyor in passing through. They serve also of great value in sampling and on keeping track of the locations of samples sent to the assayer. For instance, his sample book should show the number of his sample, date, etc., the distance east or west or north or south from plug number so and so. Thus he can trace on his map or know at any future time either on his map or on the ground the exact place from which he got his samples and thus fully locate his good or poor ore chutes.

Also from these plugs he measures his dikes, faults, breaks, crossveins, changes of level, etc., and any other features which may be of service afterwards in working on the lower levels. I will refer to this later on more fully. And here I would like to impress upon all superintendents and foremen the necessity and saving of time, money and labor derived by preserving as much as possible these marks. I know these plugs are very convenient at times to drive a track spike into a hook from which to suspend a ventilating pipe and that screw eyes are excellent things and handy to unscrew from a plug and put somewhere else to attach a chain line to, but remember that marks taken the surveyor a lot of time and trouble to accurately locate these points and as sure as they have been disturbed so certain it is that he will require time again and it may take him from a half a day to a day to renew them or to establish new points.

Of course there are times when it is impossible to preserve them. They may be blasted out in stopping, but I regret to say that many are disturbed when there is absolutely no necessity for it. Each one of these plugs also is made a bench mark for level, and the surveyor has a vertical section may be made at any time without making any new survey.

In surveying drifts, levels, crosscuts and tunnels great advantage is derived in accurately defining a small square, or rectangle, or irregularity in the walls of the drifts. It is not sufficient to measure the width of the drift at each station point and draw straight lines between them. This does not represent the drifts as they really are, but between stations offsets should be taken to show as nearly as possible the exact figure of the drift, taken either at floor level or at hip level, as the surveyor may require or desire.

These small irregularities assist often very materially in locating or finding out information which may show at a glance some feature which might have disturbed the vein or some information which may give an inkling as to where to locate an extension of some ore body or some such like features.

Maps.—The result of the survey is of course the map or plan which is compiled therefrom, and is the portion of the survey which the superintendent or manager requires and without which the survey is of little use to him. There is of course a drawing of the position which these should be made in or on to show plainly and simply all the workings and in such shape that they can be easily understood. First, I would suggest making an accurate ground plan, plotted on good backed paper to a scale of say 40 feet to one inch. Plot by means of latitudes and departures from an observed astronomical meridian showing the ground plan of all levels on the same map and tint each level with a different color. Leave the paper large enough for future workings, and plot on this each month's work, surveying showing the position of all plugs with their numbers, and in fact as much information as is possible to get on without cramping. This is the working plan.

Then I would suggest making a separate tracing of each level putting a square border around so that when the tracings are placed the one over the other with the borders directly above each other, the levels will show through the tracing lines in the proper position. One can thus see through two or three sheets and see the levels in their proper positions underneath. These tracings are for the purpose of showing the ore bodies, geology, and general features of the ground. These are for the use of the superintendent or manager, and are filed in by the surveyor, superintendent, geologist or whoever measures up the elevations. For instance, suppose this is done by the superintendent. He goes on the first level and locates all dikes, ore, cross veins, faults, breaks or changes of level, and peculiar features. He measures the distance to them from the nearest numbered plug, notes their strike, dip, width and all about them and gives them their bearings and to plot. He plots them accurately on the tracing of the particular level, showing each in distinct colors with colored pencils. This is done for every level. Then if the sheets are placed one on top of the other the superintendent can see at a glance by slipping one tracing around on the other, the dikes, ore chutes, faults, etc., which correspond to a new level, unless some new feature crops up between them he can tell just where to expect to find these peculiarities found on the level

above. So accurately can this be done that he can in many cases from his office give his direction where the drive to, and thus save many a foot of dead work.

Slope Sheets.—These are plans prepared on sheets of x section paper to show approximately the amount of ground worked out in each month and to give a great deal of valuable and necessary information. I say prepared on sheets of x section paper, for this is a very simple way of plotting them. I suggest having two colors one can see at a glance how the work is proceeding and if necessary by knowing the height of the floors apart one can exactly figure out the tonnage of ore stopped from that stoppage during the month. A simple way of carrying these slope sheets for these sheets if the stope is timbered up with square sets is in the ordinary level surveying to locate and plot several logs or posts between the levels and vertically, the one above the other, the surveyor and his helper can proceed to the first floor, get the post on top of the one he has located below, then the upper and a Brunton pocket transit can quickly survey the outline of that stoppage ready for plotting on his sheet, so on for each floor. If the stope have been taken out, the work is more difficult and the surveyor must locate and place plugs on the hanging wall at any point which he can get a sight to from the level below.

Having located these plugs and numbered them, he can drop his plumb line and proceed as before continuing his survey up through the stope and placing points from which he can make his plans. The only time that these are all the plans which are necessary.

If the head office is situated away from the mine office, in another city, and they require to keep their plans up—a good way is to divide the working plan by fine blue lines at left hand side of plan number each square with numbers such as 1, 2, 3, etc., then have along the bottom of the plan, each square by a letter as A, B, C, etc., and the surveyor can refer to the head office and it comes into square 10C, he simply has to make a little tracing of the work shown in 10C and send to the head office, and there he can plot it on their own plan which is of course a duplicate of the working plan, and ruled into similar squares. It is impossible to name all the cuts, drifts, geology or peculiarities which may be passed through. They serve also of great value in sampling and on keeping track of the locations of samples sent to the assayer. For instance, his sample book should show the number of his sample, date, etc., the distance east or west or north or south from plug number so and so. Thus he can trace on his map or know at any future time either on his map or on the ground the exact place from which he got his samples and thus fully locate his good or poor ore chutes.

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the work, namely, that of setting up the instrument at a double level and establishing two points in line with and on the plane of the wires, an extension of the base line as it were. Apparently this is easy enough but practically it is a very difficult matter. In looking at the wires through the telescope and being very nearly in line with both it is almost impossible to tell the one from the other when the reflecting paper is held behind the farthest one. Remember they are only about four feet apart. It is necessary to pull one to one side which starts it vibrating, and this means a delay of several minutes and takes the patient's patience. I think that this part of underground surveying is the most wearying, and it is only by exercising the utmost care and patience that accurate results can be accomplished, using transits instead of wires in short shafts.

Once the surveyor gets his lines exactly in line he should put in marks that will stay with his transits for the time being at an end. Very few mines can stand closing down working in their shaft for more than one day, so while one wire is down the surveyor should arrange to get the other wire up so that the work will be sufficient for all his future work. Base lines are established thus at each level and surface and the distances measured down, and the sailing from this on is easy.

I well remember one shaft I plumbed for survey in which the air was very bad. It was a double-compartment shaft, and while waiting for the time being a pump was used to draw the air out of the shaft. I could not work while the pump was going as the air was so bad that I could not breathe, and I could not use the instrument. If I stopped the pump over 15 minutes we had no air to breathe, and the candles would barely burn while the water coming through the mine would gradually work up around our knees. There was nothing to do but compromise, namely, survey for about 10 minutes, namely, 15 minutes, and so on until eventually I got everything in good shape and no more was very sorry. Incline shafts I find more easy to survey if the instrument is in good order. One can generally traverse right down the shaft by placing staves at the different levels and establishing his survey from the traverse line down the shaft. At every station level permanent marks should be put in the walls and the work without having to use the shaft again except perhaps for half an hour sometime when the shaft is off it is very advantageous to have one surveyor do all the work. He has his own points established, has checked them over and found out his error, if any, and can proceed at an instant. The other surveyor is changed it is very unfair to both. The second surveyor unless he has a chance to go over the first surveyor's work has to assume the work is correct, and is always uncertain as to his work, and has a difficult position to fill, though, of course, he has the advantage in case his work does not come out correctly in blaming the first surveyor's work for it.

I have said before, there are many other jobs a surveyor has to do in a mine which I have not touched upon, but in this thing is certain that the surveyor is always uncertain as to his work, and he must be always on the alert and ready to figure or lay out anything.

I have endeavored to show the importance of this survey work and the manner of doing it. If I have not made everything clear I will be glad to explain it again, also will be glad to answer any questions you may wish to ask me about it. Thanking you for your attention I am at your disposal for a short time.

KIDNEY-SICK PEOPLE!

By far the largest army of sufferers in the world are the kidney-sick people—but by far the largest army of the cured ones attribute their release from disease to the great South American Kidney Cure. Cures Bright's disease. Cures Diabetes. Cures all bladder ailments.



Kidney diseases are the most insidious of all diseases common to humanity; within the past few years medical science has made wonderful strides in coping with its ravages. South American Kidney Cure has proved rich in healing power, and every day testimony is piled up for its great curative qualities. Where kidney disease exists it is generally indicated by certain changes in the urine, such as mucus, sediment, albumen, brick dust, acid and blood—pain is not necessarily an accompaniment, which only aggravates the insidious nature of it. Testing and experimenting has disclosed the fact that the passing through these organs of the solid particles in the ordinary course of circulation is a remarkably short while, and that the functions of these organs are not performed and disease lays hold on the patient with a ruthless hand. Kidney diseases require a solvent. South American Kidney Cure is a solvent—it is a kidney specific—claims to be no more—it has been tested by eminent medical authorities on kidney diseases, and proved and testified to by them as the surest and safest cure for all diseases of the kidneys and bladder. It's a purifier—a healer—a health builder—efficacious alike to man or woman.

Good News from the North Country.—A young machinist in a large manufacturing concern in Northern Ontario, fell a victim to the dropsical form of kidney disease through atmospheric changes following his discharge from the army. He was almost prostrated by the physician from whom he had been receiving treatment. He visited Toronto and consulted an eminent authority on kidney diseases. The doctor sent him home with a hopeful story of his case if he could give, but wrote privately to the young man's physician that it was only a matter of time with him until death would claim another kidney victim. When he was very sorry. Incline shafts I find more easy to survey if the instrument is in good order. One can generally traverse right down the shaft by placing staves at the different levels and establishing his survey from the traverse line down the shaft. At every station level permanent marks should be put in the walls and the work without having to use the shaft again except perhaps for half an hour sometime when the shaft is off it is very advantageous to have one surveyor do all the work. He has his own points established, has checked them over and found out his error, if any, and can proceed at an instant. The other surveyor is changed it is very unfair to both. The second surveyor unless he has a chance to go over the first surveyor's work has to assume the work is correct, and is always uncertain as to his work, and has a difficult position to fill, though, of course, he has the advantage in case his work does not come out correctly in blaming the first surveyor's work for it.

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SOUTH AMERICAN NEURINE—Is a nerve healer. Cures indigestion and all stomach troubles which are forerunners of nervous collapse.

SOUTH AMERICAN RHEUMATIC CURE—Has lifted men off a bed of pain after a few days use, who have not been from suffering for years.

DR. AGNEW'S OINTMENT cures blind, itching or ulcerating piles in from three to five nights. 25 cts.

For Sale by Goodeve Bros.

BOUNDARY ROUTE

TO CHICAGO

NEW SHORT LINE

FROM MONTANA, IDAHO AND PUGET SOUND

ON WHEELING

A. C. SHELTON, General Agent, 250 Washington St., PORTLAND, ORE.

"HELLO," EVERYWHERE

Superintendent Kent Promises a First Class Service From Here.

The Boundary Creek Country Will be Connected by a Double Metallic Wire and Good Instruments Provided.

W. H. Kent, general superintendent of the Vernon & Nelson telephone company, and of the New Westminster & Burned Inlet Telephone company, limited, is in the city. Mr. Kent states that the service to be improved at once, and that every facility is to be afforded for immediately connecting all points. The company now has ample funds to conduct all its operations, and while the outside towns are now connected with but a single wire, there will be a double copper wire service from here into the Boundary district in addition to the double wire service to Spokane.

Heretofore the company has been hampered by lack of funds, but the necessities of the country and the splendid showing made by the company have induced British capitalists to put in sufficient money to establish a really first class service. It must not be understood that this will be what is known as an express service, because the cost would be too great, but equally to that of any district of the same population and of smaller area on the continent of America.

Mr. Kent says that the old instruments now in use will be replaced with more modern ones as fast as possible, and that the new company is prepared to afford such facilities as will satisfy the public. He moreover, said that the prosperity of the country meant the prosperity of the company, and that the directors of the British Columbia telephones recognized the necessities of a new company and were prepared to back him up in making such a service as would be acceptable to all the people of the Kootenays and of the whole province.

Hereafter, he said, there would be no excuse for kicks. Of course it may take a week or two, or perhaps a little longer, to get the lines and instruments in better shape, but the work was progressing so rapidly that it was only a question of a very short time before every department of the work would be in first class shape.

ANSWERS TO CORRESPONDENTS

The Muewump Is Not Being Operated.

Editor Miner—Sir: I have a small number of shares in the Muewump mine, and I am like a great many other people, unable to get out of it without a loss. I was asked to write to you, as I was told that you would be able to give some information on the subject. I would like to find out if there has been any work done on it and what are its prospects, and if there is any use in holding the stock, which I purchased at 15 cents a share.

Toronto, March 18.

[Nothing is being done with the Muewump property at present. The control of the capital stock of the Muewump Gold Mining company was purchased some time since by the Chinese and under the name of the War Eagle. The object said to have been sought by the purchase was to prevent disputes that might have arisen as to lateral rights. The Muewump is not likely to be operated for some time.]

Property Sold for Debts.

Editor Miner—Sir: Would you kindly, through the columns of your valuable paper, let me know if the International Gold-Copper Mining company is still in existence, and if they are working the property, and if so, to what success, and oblige yours, etc., C. C. D.

Kaslo, B. C., March 20.

[The assets of the International Gold and Copper Mining company were sold by the sheriff some time since for debts.]

"WAYS THAT ARE DARK."

On Friday last a Chinese washe was man walked into the Chinese house and presented Amie Morin, the proprietor, with a check signed R. Greigor and asked to have it cashed. The check was for \$50 and as Mr. Morin had known the man since for some time he had no hesitation in cashing it, well knowing that Mr. Greigor's check, if genuine, was perfectly good. He was the more unsuspecting as he did not know any of the Chinese and attended a Sunday school and been taught there to both speak and write in English. When the check was presented at the bank, the forgery was at once apparent, and the authorities were notified, but the bird was fled. He had claws and had dug his way out of town. It is supposed as was bound for Trail, but the officer could not find there. He was not an eagle, but a blackbird.

The Loss Was \$5,000.

J. L. Parker, M. E., for the Dundee Mining company, yesterday returned from a visit to Ymir. He reports that the machinery which was in the shaft house of the Dundee when that structure was destroyed by fire a few days since is practically a total loss. The loss, he says, is in the neighborhood of \$5,000. Mr. Van Etleson, the adjuster of the Commercial Union Insurance company, is at the property with an expert estimating the loss. As soon as this is determined the Dundee company will decide what sort of a plant shall be purchased and installed to replace the one that has been destroyed by fire.

THE MINER

A Contract Let for 300,000 Tons of Ore

IT ENDS IN

It is to Be Supplied to the Centre and Centre Sta. of the Trail & Humph Shut Down

The feature of the contract made by Consolidated Mining Company and the Trail & Humph Shut Down for the next two years. It includes the purchase of 300,000 tons of ore from the Centre and Centre Sta. of the Trail & Humph Shut Down. The price for which the ore is to be transported is \$8 per ton. The assumption is that the ore will be sold at a profit of 80 per cent. The contract was made by George W. Eggle, manager of the Centre and Centre Sta. of the Trail & Humph Shut Down. The ore is to be shipped to the smelter immediately. The smelter will give a profit rate of 80 per cent. The ore is to be shipped to the smelter in both the War Eagle and the Star. The profit which could be made on the ore is \$100,000. The shutting down of the Victory and the Star is to be explained. The condition of the mine is such that it is not profitable to operate. The ore is to be shipped to the smelter in both the War Eagle and the Star. The profit which could be made on the ore is \$100,000. The shutting down of the Victory and the Star is to be explained. The condition of the mine is such that it is not profitable to operate.

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