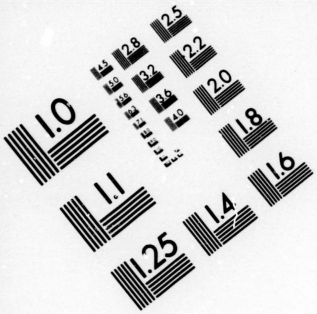


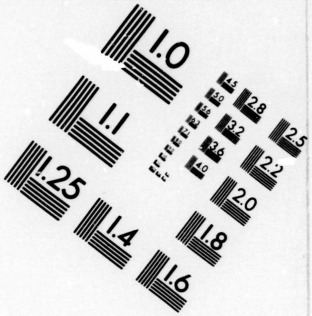
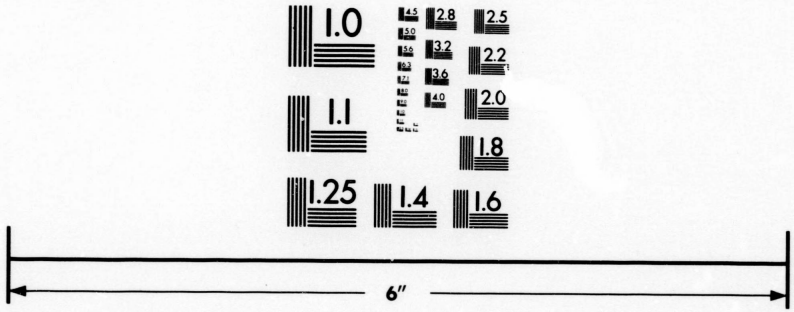
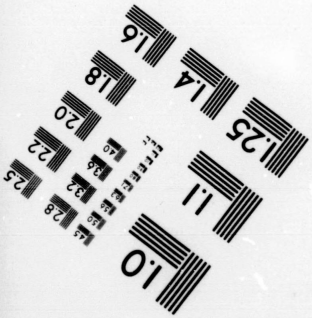
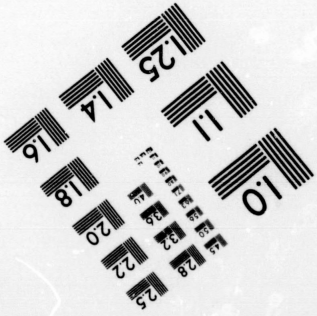


IMAGE EVALUATION
TEST TARGET (MT-3)







Photographic Sciences Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

Technical and Bibliographic Notes/Notes techniques et bibliographiques

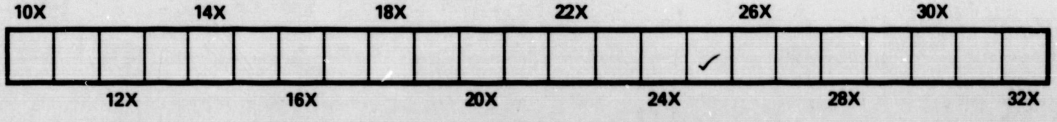
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

- ☐ Coloured covers/ Couverture de couleur
- ☐ Covers damaged/ Couverture endommagée
- ☐ Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/ Le titre de couverture manque
- ☐ Coloured maps/ Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- ☐ Bound with other material/ Relié avec d'autres documents
- ☐ Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distortion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- ☐ Additional comments:/ Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured pages/ Pages de couleur
- ☐ Pages damaged/ Pages endommagées
- ☐ Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☑ Pages detached/ Pages détachées
- ☑ Showthrough/ Transparence
- ☐ Quality of print varies/ Qualité inégale de l'impression
- ☐ Includes supplementary material/ Comprend du matériel supplémentaire
- ☐ Only edition available/ Seule édition disponible
- ☐ Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image/ Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.



The copy filmed here has been reproduced thanks to the generosity of:

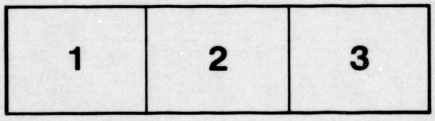
National Library of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol ⟶ (meaning "CONTINUED"), or the symbol ▽ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

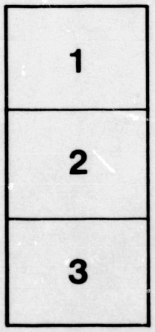
Bibliothèque nationale du Canada

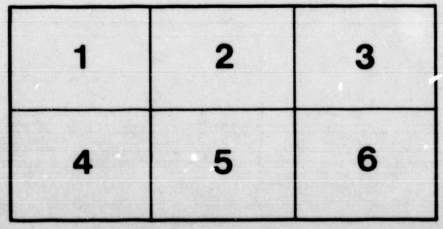
Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole ⟶ signifie "A SUIVRE", le symbole ▽ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.





II.—*On the Wallbridge Hematite Mine, as illustrating the Stock-formed Mode of Occurrence of certain Ore-Deposits.* *By* E. J. CHAPMAN, Ph. D., LL.D.

(Read May 28, 1885.)

Metalliferous deposits, viewed broadly, may be regarded as falling under the following sub-divisions: Veins, stocks, net-works, gash-lodes, impregnations, beds, alluvions. Briefly defined, without regard to accidental or local conditions, these are characterized as follows:—

VEINS are ancient fissures filled up, forming, as a rule, comparatively narrow sheets of mineral matter, which commonly pass through various kinds of rock without regard to the strike or dip of these, and which, normally, extend downward to great depths.

STOCKS are limited masses of ore, although often of large dimensions, lenticular or irregular in form, and inclined or horizontal in position. In some cases, they conform more or less to the structural characters of the rocks in which they occur; in other and perhaps the majority of cases, they shew no relations of this kind, but occupy a totally independent position as regards the enclosing rock.

NET-WORKS, sometimes called STOCK-WORKS, are assemblages of narrow, reticulating veins, branching irregularly through the enclosing rock, and commonly tapering off and dying out in thin strings.

GASH-LODES are simply narrow, often more or less linear, stocks, usually of short length, but commonly occurring in closely adjacent parallel bands, thus resembling a series of short, broken veins. As a rule, they consist wholly of metallic matter, without any accompanying veinstone or trace of vein structure.

IMPREGNATIONS consist of metallic matters diffused through zones or areas of rock in small, often imperceptible, particles, or in patches or stains. Impregnations or diffusions of this kind are occasionally of independent occurrence; but more commonly they occur in intimate connection with veins, stocks, or other ore-deposits, being evidently emanations from these, or otherwise due to similar causes.

BEDS are deposits of mineral matter lying parallel, or practically parallel, with the stratification or foliation of the rocks in which they occur, and never extending upward in strings or other prolongations into the overlying rock, as they are necessarily of earlier deposition than the latter.

ALLUVIONS cannot strictly be separated from beds proper, as they are simply beds or bedded deposits of more or less superficial occurrence, but for practical purposes they are conveniently classed apart. They consist of accumulations, from springs, streams and rivers, of detrital or precipitated matters in which metallic substances or other economic products are present.

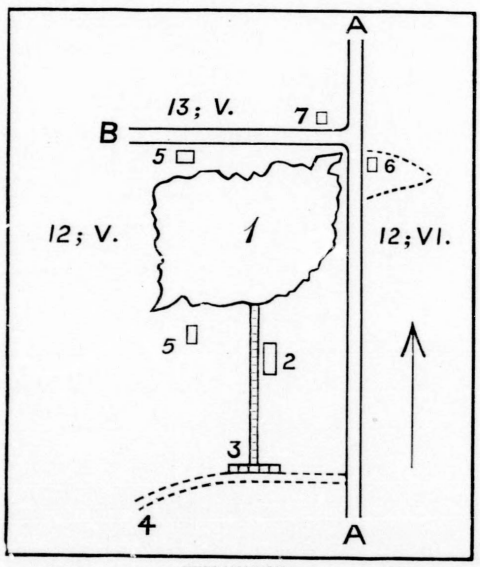
As regards Canadian iron ores, the existence of stock-formed deposits hardly seems to have been recognized, if recognized at all, in the earlier explorations of the country. Many of our iron-ore deposits, perhaps the majority, are nevertheless in that condition. In the

examination of a deposit of iron ore, as revealed by natural exposures, or laid bare by trenches or trial-pits, the presence of a stock-formed mass may be inferred in most cases from the great width of the deposit, and especially—whether of abnormal width, or otherwise—by the variations in width, and consequent irregularity of outline, which it exhibits. In the case of magnetic ores, these indications are often sufficiently revealed by the dipping-needle.

A very instructive and unmistakable example of a stock-formed ore-deposit is furnished by the Wallbridge Hematite Mine, on the twelfth lot of the fifth range or concession of Madoc, one of the southern townships of the County of Hastings, in Ontario. This mine, now practically exhausted, was opened about sixteen years ago by the late Thomas Campbell Wallbridge of Belleville. Since that date, with occasional stoppages, it has been extensively worked, and has yielded many thousand tons of red iron ore of very superior quality.

The geological features of the district in which the mine occurs were indicated briefly by Mr. Thomas Macfarlane in his Report on the County of Hastings, published by the Geological Survey in 1866, and more elaborately by the late Mr. Vennor in his able Report of 1869; but as the mine had not been opened at these dates, no information could at that time be given as regards the nature and extent of the deposit. It was previously known that the rock formations of the district are essentially of Laurentian age, overlaid, here and there, unconformably, by outlying patches of Lower Silurian limestone, now called "Cambro-Silurian" by the present Survey. According to Mr. Vennor, the Laurentian rocks of this section of country form a series of roughly-parallel synclinals with general N E and S W strike, and consist of a threefold subdivision, comprising (in ascending order): (1) syenitic and gneissoid rocks, essentially red in colour, with some crystalline, graphitic limestones; (2) dark-green, amphibolic and pyroxenic rocks with associated iron ores; and (3) various micaceous and siliceous slates, crystalline limestones, and conglomerates, mostly of a greyish colour. Whilst the general accuracy of this distribution is undeniable, I think it would be preferable to regard the series as consisting of four, in place of three, groups,—two of these being probably eruptive or intrusive, while the other two are undoubtedly metamorphic strata in the ordinary sense of the term. I would thus separate, from the lower stratified gneisses, the unstratified syenites or syenitic granites, the elevation of which has caused the synclinals determined by Mr. Vennor. The green, amphibolic or pyroxenic rocks are of doubtful origin. Although in places they graduate into schistose layers apparently conformable with the underlying gneisses, in other places they shew no distinct stratification, and at certain spots, as pointed out by Mr. Macfarlane, they present even a sub-columnar structure. I believe them to be for the greater part, if not wholly, eruptive overflows or intrusive beds from which the iron deposits have separated during consolidation. In many places they are scarcely represented at all in the series, or merely form the sheaths or enclosing rock of the iron ore. They differ, thus, in a very marked manner from the extended gneissoid beds which lie beneath them, and from the slates, crystalline limestones, etc., by which they are immediately succeeded. Here and there throughout the district, these crystalline rocks are overlaid unconformably by outlying patches of fossiliferous and nearly horizontal limestones of the Lower Trenton horizon. The elevation of the red syenites, therefore, if Post-Laurentian, must necessarily have preceded the Cambro-Silurian period.

The position of the hematite deposit, forming the Wallbridge Mine, is at the summit of the lower gneissic series, or immediately at the base of the upper series. The mine, itself, occurs on the twelfth lot of the fifth concession of Madoc, about four miles north of Madoc village. The ore, now exhausted, was in the form of a large "stock" or irregular mass, partly encased in and mixed with green amphibolic rock; but the latter is very sparingly present at this locality, and, as shewn by shafts immediately adjacent to the mine, it does not extend many yards beyond the site of the ore. The hematite has been mined by open quarrying, and the large excavation which has thus resulted shows the original mass of ore to have averaged about 170 feet in length, by about 100 feet in breadth, with an average depth of eighty feet. The weight of this mass would exceed 200,000 Canadian tons. Here and there, as in stock-formed masses generally, the ore has thrown out wedge-shaped prolongations into the surrounding rock; but these, when followed up, have been found, in every instance, to terminate more or less abruptly at distances of a few feet or yards. The floor of the excavation is now on bare rock, but in order to test the pit thoroughly, the lessees have sunk upon it a couple of small shafts, seventy-five feet apart, and about thirty feet deep, and these have been connected at the bottom by a narrow drift. The latter passed through barren ground, all the way.



EXPLANATION:

A, A, County road. B, Side road. 1. Large excavation left by removal of ore at the Wallbridge Mine, on lot twelve, concession five, Madoc. 2. Engine house. 3. Shoot. 4. Tramway. 5, 5. Sheds. 6. Shaft of Miller Mine on lot twelve, concession six. 7. Shaft on lot thirteen, concession five.

It was at one time thought that the deposit extended across the country road, in an easterly direction, into the twelfth lot of the sixth concession; but although there are undoubtedly, indications of a slight extension in this direction, subsequent explorations

have shewn that, both here and in the main pit, the ore is practically exhausted. No. 6, in the annexed sketch-plan, indicates the position of a shaft sunk on this supposed extension to a depth of nearly seventy feet. Drifts were run in an easterly and westerly direction, to a distance of about twenty feet from the bottom of the shaft. These workings were known as the Miller Mine; but in one drift little more than poor, fragmentary ore and iron-stained rock was met with, and in the other the indications were not sufficient to warrant further outlay. No. 7 shews the position of another shaft, sunk (against advice) to about the same depth of seventy feet, immediately north of the Wallbridge pit, on the thirteenth lot of the fifth concession. This passed through some light-grey crystalline limestone and then entered the underlying gnessic strata, meeting only with a small string of hematite, and with little more than traces of amphibolic rock.

A sample of ore taken some time ago from the body of the Wallbridge pit, contained by my analysis 97.18 per cent. ferric oxide, equivalent to 68 per cent. metal, with only 2.78 per cent. amphibolic rock-matter; whilst the best sample that I could get from the bottom of the Miller shaft[1] contained 23.43 per cent. rock-matter with much free silica in it, and a second sample held no less than 29.32 per cent. rock-matter.

As the working of all stock-formed deposits must necessarily be followed sooner or later by the exhaustion of the ore, and as no surface indications will enable one to predict with any certainty the amount of ore present in a stock-formed mass, greater caution than usual is required in handling these deposits. Happily, in the diamond drill, we have the means of testing rapidly and economically the dimensions and general purity of ore-masses of this character. By a few borings put down at short distances beyond the visible or supposed limits of the deposit, and in the central part of the deposit itself, not only can its dimensions be safely ascertained, but the cores of ore brought up by the drill will afford a thorough insight into the character of the deposit, from depth to depth, throughout its entire mass.

[1] At the date of my visit to this so-called mine, the drifts were entirely closed, so that I could not get into them.