THE IRON DEPOSITS OF TASMANIA

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As the initial effort to establish the iron industry in Tasmania failed owing to the presence of the element chromium in the product, it will, perhaps, be wise for us to examine the influence of this element on iron and steel. It may be considered by some as unnecessary for this matter to be dealt with, but as it caused failure before, and certainly exists in a large proportion in some of the Tasmanian ores, we will note a few of its chief characteristics, and see in what way its influence is likely to be felt in future ventures connected with iron manufacture. Before proceeding, however, let me point out one peculiarity in connection with chromium, and its presence in iron ores. It is seldom found in the iron at or near the surface, but generally at some considerable depth down. This is important, because a surface or high level sample might lead to the belief that chromium was not present, while samples taken towards lower levels might be very strongly impregnated with the element, and consequently useless for any but special purposes, and this only after special treatment.

Nearly 80 years ago Berthier publicly described and recognised the value of chrome-steel, and the method used by him for its preparation was practically the same as that of to-day. When chromium combines with iron, which it will do in almost all proportions, certainly up to 80 per cent., it appears to oxidise very readily ; to raise the saturation point for carbon ; to increase the hardness of the alloy, especially of that of hardened steel ; and probably also the tensile strength and elastic limit, while it has a very marked influence in lessening the welding power. It does not, as some have stated, take the place of carbon in giving to steel the power of being hardened upon sudden cooling, but, when present with carbon, it tends to increase the degree of hardness taken by the steel. The influence of chromium upon the hot malleableness and ductility of steel may, in my opinion, be ignored, as also its influence upon the material when under impact or quiescent load.

The well-known ease with which chromium oxidises has suggested the use of chrome (ferro-chrome) instead of spiegeleisen as a re-carburizer for the Bessemer process. But there is no reason to suppose that success would be achieved by such a method. The oxides of manganese arising from the reaction between the oxygen of the blown steel and the manganese of the spiegeleisen are fusible and scorifiable, they coalesce and rise to the surface of the molten metal. Chromium oxide, infusible and practically unscorifiable, would remain mixed with the steel, and thus break up its continuity and impair its forgeableness. To prove this contention one has but to refer to the crucible method, in which the chromium has but little chance to oxidise ; the presence of any Cr3 O4, formed while the steel is molten, is liable to cause deep, ineradicable veins in chromium steel, particularly if the percentage of carbon be low, or that of chromium high. Even in working chromium steels, a very strong and adherent scale forms, which renders welding very difficult, if not quite impossible. The suggestion to substitute chromium iron ore and calcined limestone for ferro-manganese does not appeal to me in any way, and if not condemned untried, should at all events be looked upon as a very doubtful experiment. Sufficient has been said to indicate the chemical influence of chromium upon iron and steel, and we may now turn our attention to its influence upon the physical properties. It is usually supposed that the presence of chromium raises the tensile strength of iron, but of this there is no certain proof. The greatest increase of tensile strength, supposed to be due to the presence of chromium, that has come under my notice, was only about 400lb. per 0·1 per cent. of chromium per square inch, and in this case it would be unsafe to assume that the increase was due to the presence of chromium, because other elements were present and might have had some influence. At all events one case, and that a doubtful one, could not be taken as proof that chromium did materially increase the tensile strength of iron. Again, it is stated that the elastic limit is raised even more by this element than the tensile strength; this, however, is altogether unproved. One case came under my notice where the elastic limit was nearly identical with the tensile strength, but in other samples of the same material it was either normal or unusually low, so that no reliance can be placed upon this one case.

As regards the ductility of steels, all the available information seems to show that the presence of chromium has neither a beneficial nor deleterious influence. Chromium does exert a hardening tendency. Unhardened chrome-steels are harder and more difficult to cut than chromeless steels of like carbon content, and their hardness increases with the percentage of chromium.

Judging from recent and reliable information, my belief is that chrome steel has an enormous future in front of it, and I have no hesitation in stating that the true article is fully entitled to rank as a most important material for many purposes. Several of the Tasmanian ores are eminently suitable for the manufacture of this material, and, providing the metal be produced of a uniform quality, there is every reason to anticipate the establishment of a most remunerative industry on the Northern coast of Tasmania.

Careful chemical supervision and absolute honesty between the manufacturer and consumer are the most important factors to be considered, and providing these conditions are complied with, there is no reason whatever why the venture should not be an unqualified success. Of course there are many points of importance to be considered, but a paper such as this is not the proper medium, they being purely matters of detail, and consequently uninteresting to any but those engaged in the industry.

So much then for the chromium ores and the prospect of their being developed and utilised ; now we can consider the enormous deposits of iron ore that are free from this element. These are of infinitely more importance to Tasmania, and are amongst the finest in the world. Two assay reports now in my possession give the percentage of oxide of iron as 99.05 and 99.41, which is equal to 69·33 and 69·58 metallic iron. Chromium and alumina are both entirely absent, of phosphorus, there is only a slight trace, and the sulphur is too low to be of any trouble either in the manufacture of pig iron or in the finished article. This is an exceptionally pure class of ore, easy to mine, and peculiarly adapted for treatment in the blast furnace.

It would require very little flux, and for this purpose excellent limestone exists inthe neighbourhood. This is only one of the deposits of non-chromium ores, but there are several others with practically the same composition, and which could be treated with equal facility. It is not the object of this paper to advertise the merits of one particular deposit, but rather to indicate the broad lines along which any venture must travel if the manufacture of iron and steel is to become an accomplished and remunerative fact for Tasmania. There is no doubt in the near future the great problem of localy manufacturing the iron and steel required by the Australasian colonies will have to be faced. But for the indifference and apathy shown by the different Governments of New South Wales, the manufacture of these materials would have been in full swing years ago, and they have no deposit of iron ore equal to that of Tasmania. The so-called statesmen fail to see that manufactures are the backbone of a country, and that the iron and steel trade is the basis of all other industries. If it were possible to withdraw all iron and steel from use man would soon revert to a state little better than barbarism. From the iron trade all other manufacturing industries will grow with remarkable rapidity, as has been proved in innumerable other places, and until this has been established little headway will be made towards a sound commercial prosperity. Look at America. Seventy years ago she produced only the smallest possible amount of iron, and practically no steel, while to-day she produces one-half the total output of the world, and this in the face of enormous natural difficulties. By natural difficulties is meant the awkward distribution of the three essential materials—coal, limestone, and iron. In some cases one or other of these materials has to be carried upwards of 1,000 miles to the other two, and then back, as a finished article, to the distributing centre.

We may now see in what way it would be advisable to proceed in the utilisation of these deposits of iron ore, both the chromiferous and non-chromiferous. The two classes are specially mentioned because, in the author's opinion, the secret of commercial success lies in treating the two ores at one works.

Taking the chromiferous first, it would be advisable to work in the direction of producing a steel containing a certain definite proportion of chromium. For this purpose a mixture of the two ores—chromiferous and non-chromiferous—might be made in smelting, or a percentage of the chromium pig might be added to the pure pig when melting for the production of steel. Owing to peculiar characteristics, before detailed, it would be impossible to satisfactorily deal with chromiferous pig iron in the puddling furnace for the production of malleable iron.

To utilise this material it will be necessary to convert the pig iron direct into steel, and for this purpose the Bessemer process would undoubtedly be the best. A description of this process would take too long, but it may be mentioned that its leading feature is the introduction of large volumes of atmospheric air—under pressure—beneath a bath of molten metal. The air as it forces its way upwards and through the molten metal oxidises and burns out most of the foreign elements and chemical impurities. By this method of production the material is more under control, while under skilful supervision a steel containing any desired proportion of chromium can be produced. The other foreign and deleterious elements could be removed, or neutralised, by oxidation or the introduction of some element possessing a stronger affinity for them than they have for iron: in the same way that dolomitic limestone is used in the basic process of steel manufacture to extract the phosphorus.

The most suitable method of adding the required proportion of chromium would be as follows:—Melt pure pig iron (iron free from chromium) in the Bessemer converter, and reduce it to as nearly pure ferrum as possible, then add the necessary amount of chromiferous pig, and after a few moments' violent agitation, to ensure perfect mixing, cast in the ordinary way into ingot moulds.

By this means a steel possessing all the advantages and none of the disadvantages attendant upon the presence of chromium would be produced.

There is little doubt but that a metal so produced would command a ready and profitable sale, providing buyers knew that they could buy such material, and rely upon getting a steel containing the necessary percentage of chromium, and not varying between a maximum and a minimum with a wide range.

There are innumerable purposes for which such material would be eminently suitable, and for these purposes alone should it be used. It has been stated that chromiferous pig iron ought to be used for the production of chilled shot. Beyond a doubt it would do admirably but considering that a very much commoner iron can be used at a great saving of expense it will never be adopted for such a purpose.

It will never do to try and force this material on the market except for those purposes for which its peculiar characteristics render it specially adapted.

The limit of useful application for chrome steel is clearly defined, and no efforts should be made to take it outside of this.

The blast furnace and smelting plant erected for the production of the chrome iron and steel would be equally suitable for the production of non-chromiferous or pure metal.

With the materials at hand a very fine kind of wrought iron and steel could be produced, and for best purposes nothing finer need be desired, for the materials are such that the product would be a magnificent sample, and up to any possible tests and specification requirements.

So far as the writer is aware, the Tasmanian coals are all unsuitable for smelting purposes, and even if this is not the case, the cost of transport would be prohibitive. Apart from this, the best results, both as regards the product and the financial aspect of the venture, would be achieved by smelting with charcoal. For this purpose the adjoining bush country will supply ample timber of a suitable quality at a minimum cost.

To sum up in a few words the opinions held by the writer concerning these mineral deposits of the North coast:

The non-chromiferous ores are amongst the finest known to exist in the world. They are eminently suitable for the manufacture of iron and steel of the highest possible class, they are easily mined and smelted, require very little flux, and should be reduced by means of charcoal. The best and most suitable method of producing steel from the pig iron would be the Bessemer. These ores make the finest flux for the treatment of galena and silver-lead, and should find a ready sale in this direction at remunerative prices, their freedom from alumina and chromium rendering them peculiarly adapted for such a purpose.

The manufacture of a charcoal-iron of very fine quality could be made to pay handsomely, quality being more considered than quantity.

The chromiferous ores could be utilised for the production of a high class of chrome steel, for which a good market already exists, and could be enormously increased.

The running of the two branches of the iron trade together would render the chances of success very much greater. Provided the proper course be followed, I see no reason whatever to fear failure, although many of the points and arguments in favour of such a scheme cannot be enumerated in a paper of this length.

The site for the works must be carefully selected, so as to minimise the cost of handling both raw and finished material as much as possible; the works must be laid out and constructed on the most modern design; the furnaces and plant erected according to the best scientific knowledge ; the materials assayed, analysed, and accurately graded, or classed ; and the whole business carried out under careful and competent management.

The success of such an uudertaking depends in a very large measure upon two things ; first, an accurate, minute, and scientific knowledge of the materials at hand ; and, second, the ability to deal with such material so as to achieve the best possible result.

Providing these conditions are complied with the author of these notes is prepared to guarantee success. The industry must be developed gradually, so as to avoid swamping the market, and to allow consumers to gradually acquire faith in the articles produced. Beyond a doubt Tasmania possesses enormous potential wealth in her iron deposits alone, and it will be matter for sincere regret if it is not soon turned from a potentiality into an actual source of revenue and wealth. These notes have dealt only with iron deposits, but the writer has seen magnificent samples of manganese (black oxide), asbestos, wolfram, and scheelite, all of which would pay well if worked properly.