Lime, from Marmora, McNab, Les Chats, Gloucester, Montreal, Packenham and Caughnawaga.
Trap, from St. Roch.
Marble, from Oxford, Brompton Lake, Dudswell, St. Armand, St. Lin, McNab and Pakenham.
Hydraulic Lime, from Thorold, Quebec, Oneida, Nepean and Brantford.
Bricks for Building, from various places.
Peat, from Longueuil and Sheffield.
Asphaltum, from Enniskillen.
Aerolite, found in Madoc, forming a mass of Iron with 6.35 per cent. of Nickel, weighing 370 lbs.

The Refuse of the Smelting Furnaces.*

The production of iron by the smelting-furnaces of Great Britain has reached 3,000,000 tons annually; and by a moderate calculation, it may be assumed that for every ton of iron two tons of slag are formed, making an aggregate of at least 6,000,000 tons of this hitherto refuse material. Not only has this vast accumulation of slag been to the present time comparatively useless, but it has proved an incumbrance and source of heavy expense to the ironmasters; for it is calculated that a sum of not less than £150,000 sterling is annually expended by and lost to them in removing the unsightly heaps from their premises, to be used as the most worthless of materials in mending old roads, and in filling gullies and other vacant spaces. We are, however, destined, before long, to witness this singular substance applied to economic purposes of the highest utility; and we venture to predict that it will be hereafter seen superseding the labours of the quarry, rivalling the most valuable marble, and even in beauty and brilliancy many of the precious stones, such as the agate, the jasper, the different classes of variegated marbles, and even the very attractive malachite.

We now proceed to notice a highly interesting paper, read at the Society of Arts, by Dr. William H. Smith, of Philadelphia, U.S., "On the Utilisation of the Slags, or Molten Mineral Products of Smelting Furnaces." The term "slag" has been defined by most standard authorities as the "refuse vitreous products of smelting furnaces," a definition which, being only applicable to slag in its altered conditions, after having been rendered brittle and worthless by improper treatment succeeding its withdrawal from the smelting furnace, he rejects as erroneous. In order to be fairly viewed and justly appreciated, slag must be considered both in its molten state, as a fused mineral product, and in the variety of combinations, forms, and general properties it may be made to assume, under scientific treatment, subsequent to its removal from the smelting furnace. The first general view which slags thus considered naturally present, is that which relates to their philosophic character, which we briefly notice before passing to consider a more important aspect—viz., their commercial value.

In the wide range of geological science we find but few general phenomena which cannot be elucidated by the chemico-mineralogical transformations of the smelting furnace. In that vast apparatus, by the study of existing operations, agencies, and laws, the geologist finds a clue to the formation of the earth, an exponent of those laws and phenomena which have modified and determined the condition of the rocky crust of the globe. When his cupola is built, and his blast started, the metallurgist is at once ready to daguereotype, or rather reproduce, although in minature, the mountainous deposits and diversified formation of the igneous rocks; and if his researches verge upon chemical science, in studying the agency of heat on the form colour, and other properties of matter, he can observe the influences which determine the crystaline or amorphous structure of slag, and those wonderful chemical affinities which bind together in definite atomic proportions the elementary molecules of slag, however complex the combinations it may assume under the smelting operation.

The rocks of igneous origin are well known to the scientific world, and highly appreciated by the practical architect; they are the rocks of which Nature builds her loftiest mountains, and man constructs his most enduring monuments. Many of the mountain ranges even of this island are composed of those strata which have been thrown up and altered in mineral aspect by molten masses and veins, presenting no traces of decomposition, and which, like slag, are of igneous origin. Granite, syenite, protogine, serpentine, porphyry, basalt, felspar, greenstone, lava, &c., are amongst the varieties of the igneous rocks, and the industrial purposes to which they are applied are numerous, and of primary importance. If we admit the existence of some deep-seated source of heat to which these rocks owe their origin, the analogy between them and the products of smelting furnaces, which are composed of the same elements, fused by the same igneous agency, and modified in form, colour, and character, by the same fixed chemical laws, a doubt cannot be entertained of the value of this artificial mineral product, as combining in itself qualities possessed and divided amongst many natural varieties. Selecting the slags of iron furnaces, they will be found composed of silica, lime, and alumina, as their chief ingredients, in combination with traces of magnesia, protoxide of iron, sodium, potassium, carbon, manganese, carbon, sulphur, titanium, and phosphorus. According to the analysis of M. Berthier, the slag of the Dowlais furnaces, from which some of the manufactured samples exhibited were made, consists of silica, 40·4; lime, 38·4; alumina, 11·2; magnesia, 5·2; protoxide of iron, 3·8; and a trace of sulphur. Slags from other iron furnaces in France and England presented similar analytical results, varying slightly as to the relative quantities of manganese and sulphur, while a mean average of the anthracite furnaces of America shows their slag to consist of silex 51, lime 21, and alumina 15. Prof. Philips, in his mineralogical work, observes:—"If we look more narrowly into the composition of the crust of the globe, as consisting chiefly of the earths and earthy materials, we find that only three of the earths which have been discovered—viz., silica, alumina, and lime, are found to constitute its great bulk." Regarding, therefore, silica, lime, and alumina, as the chief constituents of slag, we are furnished with the very ingredients out of which Nature has fashioned and annealed nearly all the valuable building materials of the mineral kingdom.

In the utilisation of slag for commercial purposes, by the processes of casting, pressing, rolling, moulding, and annealing, the facilities afforded by the extremely liquid molten state to which the slag is reduced in the smelting furnace are availed of, so that by suitable appliances any desired form, colour, or texture, can be imparted. We here adopt the descriptive language of Dr. Smith:—"According to the treatment it receives, slag can be rendered brittle or tough, hard or soft, compact or porous, rough or smooth. It can be cast into as great a variety of forms, solid and hollow, as iron itself, with the superior advantage of being susceptible of the admixture and blending of colours, so as to render it equal in brilliancy to agate, jasper, malachite, the variegated marbles, and other more valuable varieties of the mineral kingdom. When properly annealed, it can be made to acquire a surface, or texture, at least 10 times as durable as that of marble, and is susceptible of a polish equal to agate or cornelian. As a building material slag can be readily adapted to any variety of architectural design, from the simple slab to the most ornate and complex decoration; whilst its beauty and durability chiefly recommend it as an article of luxury."

Dr. Smith entered into a comparison of the relative expense of the manufacture of clay bricks as compared with that of bricks or blocks of slag; and he reminded us, that in making bricks of the latter, the raw material cost less than nothing, inasmuch as the ironmaster saves by its utilisation the heavy expenditure now attendant upon its removal from the furnace premises. In fusing slag for the operation of casting no expense is incurred, inasmuch as this item of expenditure is charged by the metallurgist to the metallic and *not* to the earthy products of the smelting operation; whereas, in making bricks of clay, the raw material has an intrinsic value, while the consecutive operations of digging the clay, preparing it for use, and transporting it, added to the process of pressing and annealing, consume at least twice as much time and labour as are employed in working slag. "From these simple, yet clear data," observed Dr. Smith, "we can fairly infer that the cost of making clay brick will be double that of making blocks, tiles, or more decorative and valuable articles from slag. By extending this calculation to other products, such as marble slabs, columns, carved architectural ornaments of stone, &c., and in our estimate contrasting the plastic power of fusion available in slag with the laborious hewing and fashioning by mechanical means required for blocks of marble and other stones, we may arrive at still more satisfactory results in proving the commercial value of slag."

The samples which were exhibited and examined by the auditory excited general admiration, from the closeness of the texture, the height of the polish and the beauty and apparent durability of the articles. Some of them had been made from the slags of American furnaces, others from those of the furnaces of France and England; and it was evident, from their inspection, that the commercial value expressed in the above calculation was by no means extravagant. To

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* *The Mining Journal.*