Dr. Hettner has been at work on the Andes of Colombia, and Dr. Theodore Wolf has published a magnificent monograph (in Spanish) on the geography and geology of Ecuador, accompanied by the best map yet produced of the country. Dr. Tippenhauer has written a fine work on the physical geography of Haiti, and many other papers by German geographers have appeared within the last few months.

SIR WILLIAM MACGREGOR, for the British Government, and the officers of the Dutch war-vessel *Java*, have rectified the frontier between British and Dutch New Guinea. The former boundary was the 141st meridian, and the new boundary, where it cuts the coast, is a stream, chosen to furnish a recognisable border-line, in 141° 1′ 40″ E. and 9° 7′ 40″ S.

ON August 6 the new ship-canal across the Isthmus of Corinth was formally opened, thus completing a plan which was projected by Periandros about 600 B.C., and actually commenced by Nero, who was, however, compelled to abandon the work, in 68 A.D. The canal is not quite four miles long, and will effect a saving of 120 miles in the passage from the Adriatic to the Ægean. Two new towns have been planned at the entrances to the canal, which will be named Poseidonia and Isthmia.

MR. F. C. SELOUS, the recognised authority on the exploration of Mashonaland, has been induced to return there at very short notice, on account of the threatening attitude of the powerful Matabele chief, Lo Bengula, and the consequent risk of interruption in the development of the country. An important work on Mashonaland, by Mr. Selous, will be published immediately.

MR. R. M. W. SWAN, who, with Mr. Theodore Bent, surveyed the ruins of Zimbabwe, is at present engaged in a systematic survey of other groups of ruins in South Africa, and he reports the discovery of a temple on the Limpopo, "oriented" to the setting sun at the solstice.

MR. W. H. COZENS HARDY, the Oxford geographical scholar, is now engaged in carrying out his explorations in Eastern Montenegro, one of the least known parts of Europe. The work of his predecessor, Mr. Grundy, on the Battlefield of Platæa, is on the point of publication as a supplementary paper of the Royal Geographical Society.

THE BEAVER CREEK METEORITE.

SOME of the readers of NATURE will no doubt be interested in a short account of a meteoric fall which occurred recently in British Columbia, and was noted in these columns on August 10. For the circumstances in connection with the fall, and the finding of fragments of the meteorite, I am indebted to Mr. James Hislop —a former student of this University, and a most trustworthy observer—and also to a letter by Mr. E. L. McNair in the *Spokane Review* of June 2.

Both gentlemen were members of a party of engineers engaged upon a survey for the Nelson and Fort Sheppard Railway Company on Beaver Creek, about eleven miles north and five miles east of where the Columbia crosses the international boundary line. About four o'clock on the afternoon of May 26 a series of sharp reports was heard, following one another in quick succession, and apparently occupying in all about half a minute. The first report was quite loud and sharp, and each succeeding one less so, as if coming from a greater distance. Following the reports was a whizzing sound, such as might be supposed to be produced by a body moving rapidly through the air.

At the time of the "explosion" a man named Gerling was walking along the Beaver Creek trail. At first he thought that the noise was thunder, but the whizzing sound puzzled him, and on looking upward to see if he could tell whence it came, it grew louder and louder until a stone struck the ground not far from where he stood. He searched for it, but without success, as the place was thickly overgrown with bushes.

Some distance from this a fragment fell within fifty feet of a man named Edward McLeod. It buried itself in the earth, but was dug out, and found to weigh four or five pounds. On the following day (May 27), in the course of his topographical work, Mr. Hislop came upon a freshly-made hole in the ground into which the loose earth had fallen, and on following it down to a depth of three feet from the surface a portion of the meteorite weighing about twenty-five pounds was discovered. The hole made an angle of 58° with the horizontal, and its course showed that the mass had come in a direction S. 60° E. (true meridian). The writer is indebted to Mr. Hislop for a portion of this mass, and a preliminary examination fully establishes its meteoric character.

The fresh fracture is light grey in colour and harsh to the touch, the crust being brown and dull. The chondritic character is distinctly seen without a lens, though the "chondra" are mostly under a millimetre in diameter. Examination of a thin section with the microscope showed the presence of olivine, enstatite, iron, troilite, and chromite (?). The iron is present in the form of little shining grains and strings. On treatment with hydrochloric acid the powder gelatinises readily (olivine) and evolves hydrogen sulphide. By means of an ordinary horseshoe magnet some of the powder was separated into a magnetic and a non-magnetic portion. The former amounted to about 23·5 per cent. of the whole, and consisted mainly of nickel-iron, which, however, carried with it a portion of the other constituents.

A partial analysis of the magnetic material gave:—

Iron	78·72
Nickel (including cobalt)	6·87
Insoluble in hydrochloric acid	10·04
Soluble silica	1·46
Magnesia, &c., by difference	2·91
	100·00

If all the iron and nickel present be regarded as nickel iron, the percentage of nickel (with cobalt) is 8·73. No doubt, however, a little of the iron was derived from olivine and possibly from troilite.

The writer hopes to publish before long the results of a less hurried and more detailed examination of the specimen in his possession. B. J. HARRINGTON.

SPANGOLITE, A REMARKABLE CORNISH MINERAL.

AMONG the valuable Cornish minerals from the Williams collection which have recently been acquired by the trustees of the British Museum[1] is one specimen which deserves immediate notice, since it proves to be a recently discovered mineral of which only one other example is known to exist, and that from a foreign country.

The mineral belongs to the fine series of copper ores from the St. Day mines, which are chiefly arsenates and phosphates, and among these, while it exceeds the remainder in scientific interest, it is inferior to none in beauty.

The specimen, about the size of a hen's egg, consists of a granular gossany quartz carrying on both sides a little massive cuprite, which is covered and replaced by greenish alteration products—chrysocolla, malachite, liroconite, and clinoclase—together with a little chessylite; especially conspicuous being the bright green crystals of liroconite and indigo-blue groups of clinoclase.

But among these, dispersed upon both sides of the specimen, are numerous brilliant and translucent crystals of a deep emerald-green colour, which at once strike the eye as something unusual. Their form is a hexagonal prism terminated by an acute hexagonal pyramid having the apex truncated by a single bright plane; and one cannot call to mind any other mineral having precisely this habit.

A minute group of crystals was detached and examined by Mr. Prior and myself with the following result:—The mineral belongs to the rhombohedral system, the pyramid angle being 53° 7′; it has a perfect basal cleavage; it is uniaxial, the birefringence being strong and negative; the specific gravity, determined by suspending a fragment in solution of cadmium borotungstate (Rohrbach's solution), is 3·07; it is insoluble in water, but readily soluble in acids; and is found to be a hydrated sulphate and chloride of copper and aluminium. This indicates a very remarkable and unusual composition, but the presence of both aluminium and chlorine is quite unmistakable.

In all the above characters the substance is identical with spangolite, a new copper mineral which was described by Mr. S. L. Penfield in 1890 (*American Journal of Science*, 39, p. 370).

The resemblance between the two specimens extends even to the circumstances of their discovery; the original spangolite

[1] NATURE, vol. xlviii. p. 357.

was found in a collection of minerals where it had attracted no attention until Mr. Spang obtained the specimen and brought it to the notice of Mr. Penfield; the present specimen has probably remained unnoticed in the Cornish collection at Caerhays for a large number of years.

The local collection from which the American specimen was obtained belonged to a man living near Tombstone, Arizona, who had gathered together his minerals within a radius of about two hundred miles, so that although the exact locality and mode of occurrence are unknown, it is almost impossible that this specimen can be also Cornish.

From the typical character and appearance of the associated clinoclase and liroconite the British Museum specimen (although no label or history is attached to it) can be pronounced to be without the least doubt from the St. Day district, near Redruth, in Cornwall.

The American specimen is described as "a rounded mass of impure cuprite which was mostly covered with hexagonal crystals of spangolite, associated with a few crystals of azurite and some slender prismatic crystals of a copper mineral containing chlorine, probably atacamite"; it therefore differs considerably from the Cornish specimen as regards the associated minerals.

The only apparent difference between the spangolite on the two specimens is in the habit of the crystals, which in the American mineral are short prisms with bevilled edges and a large base, quite unlike the acute Cornish pyramids in aspect. The pyramid angle found by Penfield is $53° 11\frac{1}{2}'$, and the specific gravity 3·141. Penfield further made some interesting observations concerning the etched figures of spangolite; he describes and figures certain beautiful triangular markings produced upon the basal plane by the solvent action of very dilute acids. We have found that precisely the same characteristic figures are engraved upon a cleavage flake of the Cornish mineral when it is immersed for a few minutes in dilute acid.

The American crystals attain considerable dimensions; the largest had a length of $5\frac{1}{2}$ mm. and a breadth of 8 mm, and by sacrificing half the specimen Penfield was able to obtain more than 3 grams (!) of pure material for analysis. The Cornish crystals are not more than $2\frac{1}{2}$ mm. in length and $\frac{3}{4}$ mm. in breadth, and it will be difficult to obtain sufficient material for a complete analysis, unless other specimens can be found. This is unfortunate, for the composition is so peculiar that, although Penfield's analysis is without doubt perfectly reliable, it would have been interesting to confirm his formula from a new locality. The preliminary examination serves, however, not only to establish the identity of the mineral, but also to prove the most important point—that the aluminium and chlorine are essential constituents.

The formula deduced by Penfield is

$$Cu_6AlClSO_{10}.9H_2O.$$

in which, as he remarks, the aluminium is just sufficient to satisfy the quantivalence of the total acids, thus:—

$$(AlCl)SO_4.6Cu(HO)_2.3H_2O.$$

The mineral is therefore closely related to connellite, a very rare sulphate and chloride of copper also found in the St. Day district, which, moreover, it somewhat resembles in appearance, having the same black colour when viewed by reflected light alone. The colour by transmitted light, together with the perfect basal cleavage are, however, sufficient to distinguish spangolite from all known minerals; further, the basal plane is as common on spangolite as it is rare on connellite.

It is to be hoped that search will be made among old collections and upon copper ores from St. Day for further specimens of this interesting mineral. H. A. MIERS.

DESULPHURISATION OF IRON.

THE elimination of sulphur from iron and the chemical reactions, whereby sulphur, in the presence of powerful basic materials, is removed from crude iron, has recently attracted considerable attention. There are many reasons for this; pure ores have become comparatively scarce, and to some extent the same may be said of the fuel or coke used in the process of smelting. And even if this be not strictly applicable in all districts where the manufacture of iron is pursued, yet it cannot be gainsaid that excessive competition, with concurrent low prices, have had an influence in rendering the strictest economy in the manufacture absolutely necessary, and thus in a measure preventing the free use of pure high-priced materials.

I may even go further and assert that under favourable conditions, that is, as regards general manufacturing expenses, localisation of plant, &c., the cost of pure good materials, unquestionably suitable for smelting purposes, may become quite prohibitive. In numerous instances manufacturers have therefore been compelled to use cheaper fuel and ores falling within the margin of economic working. At this point, however, other fresh difficulties have to be combated; for when the problem of the production of iron and steel at a reasonable rate has been solved, it is too often found that the metal thus manufactured fails to meet demanded requirements. It is often the case that when iron thus produced is converted into steel, a want of uniformity in quality can be distinctly traced throughout the manufactured product. Though the steel can hardly be termed bad, nevertheless, as a general rule, it compares unfavourably with the metal smelted from purer ores with good fuel or coke.

The causes tending to the production of this inferior metal or steel are well known, and may be summed up in a few words. (1) The use of inferior coke in the blast furnace is at once a cause of deterioration, for the heat is less intense, and this tends to the production of a low grade iron.

(2) It is evident that the use of inferior cheaper ore causes a further deterioration in quality, whilst any attempt to remedy this by lightening the furnace burden of ore—in other words, using a greater quantity of coke—is, in many instances, counterbalanced by the inevitable additional impurities charged, *i.e.* sulphur and phosphorus, and other additional incombustible matter or ash.

It follows as a matter of course that the blast furnace can only work in this direction within a very narrow limit, either plus or minus attempts to limit the quantity of coke used resulting, as before said, in the production of low grade iron. On the other hand, an increased quantity of fuel with the use of inferior ore increases the total amount of impurities.

The working limit on either side is soon reached, and any further attempts at improvement either way become simply useless. Certainly, very highly heated air or blast might to some extent obviate some of the difficulties, but as in modern practice this is already thoroughly carried out, the employment of a higher temperature of blast would appear to be practically impossible, and it is very likely that the attempted use of abnormally heated blast or air would entail other serious practical difficulties.

This is the common experience of those engaged in the manufacture of iron and steel, more especially in blast furnace smelting operations, showing that under the unfavourable conditions before mentioned, it is practically impossible to produce a high-class iron containing the minimum percentage of sulphur and phosphorus together, with the requisite quantities of silicon and graphite necessary to ensure the production of good steel.

Thanks to the pain taking investigations of Mr. Stead, we can now form a tolerably clear idea of the reactions involved in the elimination of sulphur, both in the blast furnace and by other or secondary processes. These may be broadly summed up in his statement that sulphide of iron is dissolved out of the metal in the first instance by free or loosely attached lime, in a highly reducing atmosphere at a high temperature, as by the Saniter process, where lime dissolved in calcium chloride is used; and in the blast furnace by the excess of lime in solution in the slag, or even a mixture of ordinary blast furnace slag and lime, the latter being capable of eliminating sulphur from iron, and may be substituted for Saniter's mixture. The results, however, so far as can be ascertained, are somewhat irregular with either of these methods. Finally, there can be little doubt, as suggested by Mr. Stead, that if lime alone is brought into intimate contact with molten iron by suitable mechanical appliances, neither calcium chloride nor slag is needed, these having little or no direct chemical action on the metal, but merely forming vehicles for the transmission and mixing of the lime with the iron, and consequent washing out of solution of iron sulphide, followed by the subsequent conversion into calcium sulphide and iron oxide.

"The reactions in this process are, however, exceedingly complex, and there are changes which occur of which we know little or nothing. It is, however, my opinion that the sulphide of iron is dissolved out of the metal in the first instance by the free or loosely-attached dissolved lime; but I do not care at present, without more extended investigations, to hazard an