

consists of hills of Skiddaw Slates, the eastern side, with the exception of a narrow strip near the water about Lowdore, is composed of hills of the volcanic series. Now were the two sets of beds conformable, as they have hitherto been generally considered to be, and as they have always been mapped, this would require a fault along the lake with an enormous throw, which would, doubtless, highly delight those persons who, having surveyed but little, fancy there are always faults along valleys, especially if the valleys are occupied by lakes. If, however, the two sets of beds are unconformable, of which I have very little doubt, then the structure of the country is perfectly intelligible, without calling in the aid of a fault, which, however, may exist for aught I know.

As I have alluded to those theorists who used to explain lakes as lying in open fissures caused by faults, of the existence of which fissures there is not a particle of positive evidence—a race of Geologists, which I fear is not yet extinct, though they doubtless received their death-blow in the excellent paper by Professor Ramsay on the origin of lakes—I may as well say that I saw several instances in the Lake Country of lakes lying in true rock basins; for instance, Thirlmere lies in a rock basin. Again, there can be no doubt, from the great spread of alluvium, that part of Borrowdale above the Bowder Stone was once occupied by a lake as far as Seatoller certainly, which lake probably split into two arms running some way up the two valleys of Stonethwaite and Seathwaite. Now this old lake was enclosed in a rock basin, the well glaciated barrier of which crosses the valley a little south of the Bowder Stone and blocks it up, save where the stream has cut a narrow channel for itself.

The gradual silting up of the lakes is also well exhibited in many of the still existing lakes. Derwentwater and Bassenthwaite are separated by a wide, low alluvial flat, but little higher than the levels of the lakes, which doubtless once formed one great lake reaching as far as Grange. Similarly, Buttermere and Crummock once formed one lake, which reached more than half a mile higher up the valley.

NOTICES OF MEMOIRS.

TRANSACTIONS OF THE MANCHESTER GEOLOGICAL SOCIETY. Vol. vii., Part 9, and Vol. viii., Part 1. 1868.

PART ix. contains a paper by Mr. P. S. Reid, on some copper, iron, and other mineral deposits of the Maritime Alps, in the districts of St. Sauveur, Valdeblore, and St. Martin de Lantosque.

The mines of St. Sauveur and Valdeblore are situated on the French and Italian frontier, about 35 miles from the town of Nice.

The predominant formation is Jurassic Limestone, under which and reposing on Mica Schists are metamorphic rocks, answering in a great measure to our New Red Sandstone formation, and in these the principal deposits of copper, now described, are found.

Beginning with the mines of Cluchlier, near Valdeblore, the whole structure of the mountain appears to consist of a series of red schists, alternating with beds of white sandstone passing into quartzite, the mass being several hundred yards in thickness and resting on massive aggregations of gneiss, which come to the surface at Millefont, and are there found to be prolific in veins of iron ore.

The strata of schist and sandstone, which have been much metamorphosed, yield no organic remains, but in the Jurassic limestone or Lias, immediately above them, are found quantities of Belemnites and Ammonites.

French geologists consider the position which these rocks ought to occupy in the geological order of formations, quite an open question: some class them with the shales of the Lower Lias, some amongst the variegated sandstones of the Trias, and others amongst the Permian rocks, in consequence of certain analogies with the copper schists of Mansfeld; whichever may be their true position, the strata in question are eminently metalliferous, and the whole series occupies an extensive area in the "Alpes Maritimes" extending over forty or fifty miles of country.

With reference to the rich ores, they are chiefly Phillipsite, which is found mixed with certain proportions of sulphide and carbonate of copper. The usual gangues are clay-slates and quartz; but there are also found in them accidental fragments of other minerals, such as sulphate of baryta, fluor spar, specular iron ore, and chlorite.

Immediately to the north of the village of Rimplas, and on the opposite slope of the mountain called Cluchlier, another formation of copper has been discovered. Mr. Reid considers that these two deposits of copper, though differing greatly in character, will ultimately be found to be identical. It is well, however, to remark that the Rimplas formation partakes much more of the nature of that found in the Cornish copper mines than of that of Cluchlier.

Geologically considered, the enclosing rocks are precisely the same as those of Cluchlier. Several metalliferous and carbonaceous deposits crop out on the side of the mountain; and both here and at Cluchlier in the valley of La Bonlinette, are found two distinct beds of anthracite coal, of an excessively sulphureous nature. These coals do not appear in either case to be conformable with the red schists forming the enclosing rocks of the copper formation, but to belong to the Jurassic series.

About three to four miles north of the villages of La Bouline, La Roche, and the Cluchlier mines is situated the mine of Millefont. Numerous outcrops of rich iron ores are traceable, by excavations crosscutting several yards of ore in eight distinct veins.

The minerals present two principal varieties, viz., micaceous specular iron ore, and compact red hematite.

These ores are very pure, and treated in a charcoal crucible have yielded seventy-two per cent. of iron.

On the western portion of this district a regular vein of massive galena, mixed with zinc blende, has been opened, with about five inches thickness of ore enclosed in gneiss passing into mica schist.

The assay of selected samples produced sixty-nine per cent. of lead, with fourteen ounces of silver to the ton of lead worked.

These mines of iron, though exceedingly rich in metal, labour under the disadvantage of want of mineral fuel. Wood certainly exists, and in fair quantities, but in the present day the competition with coke-made iron is too serious to induce large operations in them. Railways and good roads may some day make these valuable deposits available. At present their superabundance is excessive in comparison with the means of treating them.

The first part of Vol. viii. contains the Annual Report of the Council for the past year, etc.

SHORT NOTICES OF SCIENTIFIC PAPERS.

I. ENARGITE FROM CALIFORNIA. — MR. E. W. ROOT gives us the following account of this mineral :—¹

It occurs both massive and crystallized in small rhombic prisms whose planes are much striated. The crystals possess a brilliant metallic lustre, are of a greyish-black colour, and about a millimetre in length. In the massive state it is somewhat coppery in colour when fresh fractured; exposed surfaces have a dark-bluish tarnish. It is very brittle. Streak black. Hardness about 4. Sp. grav. 4.34. B.B. decrepitates with violence, and fuses readily to a globule giving off arsenical and sulphurous fumes, and forming a coating of antimonous acid.

With fluxes it gives the copper reactions. It fuses readily at a gentle heat in a closed tube, giving off a yellow sublimate of sulphur, and at an increased heat a reddish sublimate of tersulphide of arsenic. It is insoluble in hydrochloric acid. Soluble in nitric acid with a residue of sulphur and antimonous acid. Associated with the specimen was a little iron pyrites and quartz, and a few small shining particles which, before the blowpipe, gave the reactions for iron and titanio acid.

In two analyses the following results were obtained :—

	No. 1.	No. 2.	Mean.
S,	31.81	31.51	31.66
Cu,	45.94	45.95	45.95
As,	13.65	13.74	13.70
Sb,	6.03	— ²	6.03
Fe,	0.81	0.64	0.72
Si O ₂	1.03	1.13	1.08
	99.27		99.14

If the iron present is considered as iron pyrites, and this, together with the silica deducted, the following mean is obtained :—

S.	Cu.	As.	Sb.
31.68	47.21	14.06	6.19 = 99.14.

This Californian Enargite differs from those heretofore described in having a much larger proportion of the arsenic replaced by

¹ For a full account, see Silliman's Journal, No. 137, vol. xlv. pp. 201-203.

² In analysis No. 2, owing to accident, a part of the antimony was lost, but still some 5 per cent. remained.

antimony. It contains 6 per cent of antimony, whilst that from Chili, analyzed by Field, contained none; that from Peru, analyzed by Plattner, 1.61 per cent.; that from New Granada, analyzed by Taylor, 1.29 per cent.; that from Colorado, analyzed by Burton, 1.37 per cent.

The mineral was obtained with copper ore from the Morning Star Mine, Mogul District, Alpine Co., California.

II. OVER THE ANDES AND DOWN THE AMAZONS.—MR. JAMES ORTON records his observations made during a scientific expedition across the continent of South America in 1867.¹ The route was from Guayaquil to Pará *via* Quito, Rio Napo and the Amazons. Mr. Orton carried two mercurial barometers (one short, beginning to mark at 9,000 ft.), a Wollaston boiling-point apparatus, and Boussingault's ground thermometer. He tabulates more than 50 observations, commencing at the Pacific and rising to Arenal 14,250 ft., Pichincha 15,827 ft., Antisana 16,000 ft., Cotopaxi 12,860 ft., and descending the Amazon Valley to the Atlantic, which, if reliance can be placed on his barometric observations, stands two feet lower than the Pacific, off Ecuador. This he suggests may be due to the attractive power of the great chain of volcanic mountains of the Andes acting on the ocean at their feet. At Panama, he adds, the Pacific and Atlantic sink to a common level, for there the Andes drop down to an insignificant altitude. Mr. Orton's observations at Guayaquil, on the Pacific, were taken in July; those at Pará, on the Amazon, in January, with the same instrument.

Mr. Orton noticed some singular local variations of the barometer and boiling apparatus on the Amazons, and concludes, that of the two, the mercurial barometer is more reliable than the boiling-point apparatus. The heights, as given by other travellers, express the altitude above the Atlantic; Mr. Orton has taken the Pacific as his base-line.

If only we had a greater number of these data to deal with what important and interesting results might we not hope to arrive at.

III. GEOLOGICAL NOTES ON THE CAUCASUS.—CAPT. F. VON KOSCHKULL communicates some interesting Notes on the Caucasus,² or that region which divides the Black Sea and the Sea of Azoff from the Caspian Sea, and usually called the Isthmus of the Caucasus. This mountainous band unites Southern Russia with Asia Minor.

Capt. Koschkull sees evidence, in the valley of the Kur on the Caspian side, and the valley of the River Rion leading into the Black Sea basin, of the remains of straits which formerly united the Black Sea and the Sea of Azoff to the Caspian. He considers that the upheaval of the Karthlo-Imeritian Mountains and the plateau north of the Elbruz mainly caused the separation of these two basins which now stand at such different levels; for the Caspian is nearly 80 feet below the level of the Black Sea.³

¹ Silliman's Journal, No. 137, pp. 203-213.

² Silliman's Journal, Vol. xlvii., No. 137, pp. 214-221, and No. 138, pp. 335-347.

³ The Caspian Sea has no inlet, and the waters may owe their depressed level in part to evaporation, the summers being very hot.

The central part of the principal chain of the Caucasus is composed of igneous and metamorphic rocks, as granite, gneiss, felspar, porphyry, diabase, melaphyre, basalt, diorite, trachytic tufa, obsidian and phonolite. The sedimentary rocks which cover the igneous rocks and enter so largely into the composition of the Caucasian mountains belong to the Jurassic and Cretaceous formations, including the Lias and Oolite (both largely developed), the Greensand, Gault, and White Chalk. The Tertiary strata representing the Eocene, Miocene, and Pliocene deposits, all rich in fossils, are spread over the plains bordering the great Caucasian chain. The older sedimentary deposits are considerably folded, and the Eocene and Miocene deposits exhibit some of the undulations of the subjacent rocks, but the Pliocene and "Aralo-Caspian" deposits are nearly always horizontal. This is extremely interesting as fixing the period of elevation of the chain in the Miocene epoch. Argentiferous Galena appears to be very widely distributed through the older rocks, and to have been extensively worked from a very early date by the Greeks, etc.

The Russian Government now possess the mines, and, in the few years that regular smelting works have been established, they have yielded 1,600 kilogrammes of silver, and 1,600,000 kilogrammes of lead.

Coal of Jurassic age occurs on both slopes of the Caucasus, and during the last ten years has been mined by the Russians at Kuban to the amount of 4,000,000 kilogrammes per annum. On the banks of the Rion, the coal-beds have an aggregate thickness of 28 feet.

Extensive Rock-salt mines of Tertiary age also occur, and most ancient workings were seen by the author, in which he discovered hundreds of stone implements, evidently used as mining tools, formed with considerable skill out of a tough hornblendic rock. Salt is not only procured abundantly from the Rock-salt mines but also from the evaporation of the salt-lakes in the Caucasus. The former yield about 24,000,000 kilogrammes, and the latter 16,000,000 kilogrammes, annually. Sulphur and alum also occur in abundance. Abundant supplies of petroleum, varying in density from very fluid, light-yellow oil to viscid, dark-brown mineral tar and asphaltum, occur in the Upper Tertiary strata, and, like the rock-salt mines, some of the oil-wells are of unknown antiquity.

On the eastern shore of the Caspian 20,000 wells have been sunk with proportionate results.

Captain Koschkull gives the estimated annual yield of three oil regions in the Caucasus as follows :

	Kilogrammes.
1. Peninsula of Abscheron	8,640,000
2. Valley of the Kur	192,000
3. Valley of the Saundga	320,000

Mud volcanoes now or recently in action occur in the peninsulas of Abscheron and Taman.

The craters of these volcanoes are from 200 to 1,000 feet in height, and sometimes 700 feet in diameter. Thermal springs are

also abundant. Since the complete subjugation of the country by the Russians in 1864, efforts have been made, with more or less success, to develop the resources of this interesting region, so full of relics of the early races of mankind, and so rich in classical reminiscences.

REVIEWS.

I.—VESUVIUS. By J. PHILLIPS, M.A., etc. Printed at the Clarendon Press, Oxford, 1869.

II.—MOUNT VESUVIUS, ETC. By J. LOGAN LOBLEY, F.G.S. Stanford, 1868.

THE past year has been signalized by a more than ordinary activity in the subterranean phenomena of seismic and volcanic disturbance. And hence, perhaps, has arisen a more general desire for information on these subjects to which we owe the two publications of which the titles are given above.

The work of Professor Phillips is, as might be expected, by far the most scientific and authoritative. It forms the substance of lectures delivered before the University after his return from a visit to Naples in the spring of last year, and is illustrated by numerous woodcuts, chiefly from the Professor's own pencil; others being reduced copies of authentic drawings, or engravings of earlier dates. Its contents are arranged in a threefold division. The first, containing a history of the mountain called Vesuvius, and its successive eruptions, by far fuller and more complete than any to be found in the works of Hamilton, Lyell, Daubeny, or the other writers on the subject. The second arranges the main facts and phenomena which have been observed in and around Vesuvius in a settled order. The third attempts the interpretation of these observations by reference to the physical and chemical laws of nature, giving, in fact, the Professor's view of the character and origin of volcanoes in general.

The first recorded eruption of the mountain, is that of A.D. 79, so graphically described in the well-known letter of Pliny the younger, relating to the death of his uncle, and to which catastrophe the cities of Pompeii, Herculaneum, and Stabiae, overwhelmed by accumulation of ejected ashes, owed their destruction.

By the explosions of this eruption one half of the circumference of the old crater, which more than a century before had sheltered the banditti of Spartacus, was blown into the air; the remaining segment still forming the hollow semi-cone called Somma. The author justly, as we think, supposes that before the formation of this early crater, the slopes of Somma were continued all around up to a single conical summit, probably 3,000 or 4,000 feet higher than the present mountain. The subsequent eruptions, which have continued with more or less intermission to the present day—quiescent intervals lasting sometimes for centuries, at others only for a few years or months—have raised the existing cone of Vesuvius in the centre of the old crater, of which the western border remains only