Figs. 8–18. *Rhizophyllum Gotlandicum*, F. Roemer. sp.

8. Three-quarters view of a characteristic specimen.
9. Young specimen, showing the openings of the root-channels.
10. Long and slender specimen.
11. View of interior of the calyx, seen from above.
12. Specimen showing the reduction of the calyx and rootlets.
13. Shell with operculum and rootlets.
14. Specimen with buds.
15. The operculum from the outside.
16. Inner side of operculum. *o.*, oval pit; *m.*, middle ridge.
17. The middle ridge and oval pit of another operculum moderately enlarged.
18. Vertical section of shell exhibiting its internal structure.

Figs. 19–23. *Hallia calceoloides*, n. sp.

19 and 20. Front and back views of the shell.
21. The interior of the calyx.
22. Operculum seen from without.
23. The same on the inner side. (The tube on the interior margin is accidental.)

Fig. 24. Tubes of *Favosites Forbesi*, Edw. and Haime; the opening covered with shell substance.

NOTICES OF MEMOIRS.

I.—Professor Daubreé on Meteorites and their Composition.

With Critical Notes, by M. Louis Sæmann, Memb. Inst., etc.

M. PROFESSOR DAUBREÉ presented to the Academy of Sciences at the Meetings in January 29, February 19, and March 19, the results of a series of experiments on Meteorites and their composition.

The first paper treats of a direct fusion of meteorites; and it is the improvements which M. St. Claire Deville has introduced, in the means of obtaining the highest temperatures, which have suggested the experiments of M. Daubreé, or rather have made them possible.

The process of fusion only differs from the ordinary method in the choice of fuel and the better construction of the furnaces. The fuel used is gas-retort carbon, arising from the decomposition at a red heat of the hydro-carbons of the coal-gas. Its use as a fuel requires an excessively powerful draught which in the experiments in question was obtained by a chimney 40 metres high (125 feet). Lastly he makes use of Schlœsing's apparatus which allows him to work with the fittings of an ordinary laboratory.[1]

The experiments have given from their commencement this remarkable result, that all meteorites may be divided into two classes,

[1] Schlœsing's apparatus consists of a coal-gas and compressed air blow-pipe, similar in principle to Griffin's blast-furnace, and with which in about half-an-hour may be melted several hundred grammes of malleable iron.

(1) those which give after fusion a crystalline mass, and (2) those which give a vitreous mass.

Setting apart the disseminated metallic bodies which seem to be purely adventitious, and without essential relation to the stony mass which they accompany, it is easy to see that the crystallized fused masses (*culots*) correspond to the meteorites composed principally of magnesian silicates; and that the vitreous *culots* arise from aluminous silicates.

Professor Daubreé has obtained this second result from the meteorites of Tuvinas, of Stannern, and of Tozac, but, as is already known by analysis, this division of aluminous meteorites is extremely rare; only four being known, out of 150 different stones preserved in the collections examined.

The other meteorites belong to the magnesian type and give (even the carbonaceous varieties of Alais, Orgueil, and of Kaba) a crystalline *culot* composed of two substances easily distinguishable with the naked eye, which analysis and mineralogical examination have shown to be the mono- and the bi-silicate of magnesium and iron, corresponding to "Peridote" and "Bronzite,"[1] the varying proportion of these two silicates constituting the principal differences observed in these meteorites.

That of Chassigny (1815) gives a well-crystallized mass of Peridote, whereas that of Bishopville (1843) furnishes prisms of true Enstatite of perfect whiteness, covered only here and there with a few plates of Peridote. The meteoric stones of the magnesian series subjected to fusion are those of Ensisheim, of L'Aigle, Charsonville of Chantonnay, of Agen, of Vouillé, of Favars (1844), of Montrejeau, of New Concord, and of Aumale in Algeria (1865). M. Daubreé concluded from this first series of experiments that meteorites have never been completely fused, and he confirms the observations of Mr. H. C. Sorby, F.R.S., that their stony parts present rather the appearance of an agglomerated crystalline powder.

One result, which the author forgets, although it presents itself at first sight, is that his work furnishes an excellent and true classification of aerolites.

His experiments confirm that the intermixture of iron and stone has no scientific importance: it is a purely accidental occurrence; there may be little, much, or no metallic substance, without its materially influencing the stone. It is probable that in future meteorites will be divided into two groups, aluminous, and magnesian; separating them practically, according as their fusion product is vitreous or crystalline. The second group will be arranged in the order of predominance of one or the other of the two silicates; and

[1] We employ in preference the name of "Bronzite," because it is this mineral which in terrestrial rocks most generally accompanies Peridote and Serpentine, and because besides nothing proves that the proportion of the iron in the fused bi-silicate has not diminished by fusion. M. Daubreé employs the name of Enstatite, which it would be well to restrict to the type of pure bi-silicate of magnesium, which is as rare in nature as the bi-silicates of iron and calcium, of which the mixture in diverse proportions constitutes the extensive group of pyroxene and amphibole.

one will distinguish the varieties according to the presence or the abundance of the metallic iron.

We leave this last substance to be treated of separately, as the author has already done in his second paper, entitled "Attempt to Imitate Meteoric Irons."

The study of the meteoric irons leaves no doubt of this fact, that the rectilinear lines known as "Witmannstaetten figures," which many present when etched, are only the result of the crystalline structure of these bodies. No one, however, has succeeded in reproducing these figures on ordinary iron of a crystalline structure, such for instance as iron axletrees which have become crystalline after long use.

Thus it was evident that it was not this crystalline structure alone which produced the figure. By melting the iron of Caille, M. Daubreé had at first established the fact that the figures did not reappear, whereas they were indicated in the iron extracted from the fusion product of certain meteorites. Soft iron fused, although eminently lamellar, yielded them as little. Successive additions of nickel and protosulphide of iron brought out the designs, although much less distinctly than in the meteoritic irons. It was only by adding phosphide of iron in proportions rising from 2 to 10 per cent. that the phenomenon presented itself with all the distinctness observed in the meteoric irons.

The phosphide of iron, whiter than the pure iron, interposes itself between the lamellæ of the crystalline iron, and brings out the figures with greater distinctness, independently of its colour, since it is unattackable by acids, and thus produces a design in relief. It is, besides, to be remarked that this design is not necessarily rectilinear; the iron of Atacama presents it in curved lines, without any geometrical regularity.

The largest *culot* melted by M. Daubreé weighs two kilogrammes, and was obtained by the fusion of 1,800 grammes of soft iron, 170 grammes of nickel, 50 grammes of phosphide of iron, 40 grammes of protosulphide of iron, and 20 grammes of white cast-iron, very rich in silicum. The reticulated design which it shows is small, compared to that which is observed in many meteorites; a difference attributed with great plausibility to the rapid cooling of iron melted in a crucible.

Notwithstanding the observations of the author on the irregular and concretionary form of the iron in meteorites, it would seem that experiment contradicts the result as regards temperature obtained with the meteoric stones. It cannot be admitted that the structure of meteoric iron should be due to anything but complete fusion, followed by a slow cooling, and as the fusion-point of iron is very near that of peridote, one does not understand why this latter substance is not fused at the same time; the more so since it exists in meteoric irons—that of Pallas, for instance—in which true crystals of peridote are found disseminated through the mass of the iron. A very interesting experiment consists in subjecting certain rocks and minerals to fusion in brasqued crucibles, so that the carbon of these latter, acting on the silicates of iron, effects their reduction in part.

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Peridote, Hypersthene, Scherzolite, Basalts, and Melaphyres, melted under these circumstances, allow metallic granules to separate, composed of iron containing nickel, chromium, and phosphide of iron, just like meteoric irons, according as the substance contained oxide of nickel (or peridote) or chromium, or phosphates, apatite occurring frequently as an ingredient in eruptive rocks.

Here we enter upon geology proper. Whatever may be the mode of formation of meteoric stones, of which the author has not unveiled the mystery, it is certain that some terrestrial rocks, and at their head scherzolite, present a composition identical even in its variations with that of the common type of meteorites. It is well known that scherzolite is a common eruptive rock in the Pyrenees, and, since the work of Charpentier, passes generally for a massive variety of pyroxene. M. Damour has made a very careful study of it, which has proved that this rock is a mixture of peridote, bronzite, and green pyroxene, with a trace of spinel. The formation of spinel is due, probably, to the incapacity of silica for forming silicates poorer in silica than the monosilicate. We have rendered it probable[1] that the presence of sulphuric, hydrochloric, and even carbonic acid, in certain silicates, is due to the same cause, and indicates what takes place at low temperatures. When, on the contrary, an elevation of temperature prevents these acids from assisting at the formation of silicates, equilibrium is produced by the elimination of bases, (alumina and magnesia) in the state of spinel, sometimes, perhaps, even in the state of corundum. M. Damour has further shown that the great balls of granular peridote that are met with at Beissac in Haute Loire, and in the volcanic ash of the crater of Dreys in the Eifel, have the same composition, and can therefore be considered as of similar origin. These rocks then, when fused, behave exactly as meteorites; they differ from them by a more complete oxydization of their elements. This fact being well established, it becomes important to seek carefully the rocks that it is possible to refer to the same type. If, as the author thinks, mete-orites may be considered as a *universal ash* (scorie universelle), it is necessary to show the existence of a compound analogous on the greatest number of points, or to explain what is become of their mass (ce que leur masse est devenue). But the serpentines had already been pointed out as subjects proper for experiment because of their intimate and long known relation to Peridote; and it is here that the importance of this process of fusion is most distinctly seen. Serpentines, in fact, are far from behaving in a uniform manner, and it is singular that the purest of them all, that of Snarum, of a fine greenish-yellow colour, and which frequently presents pseudomorphs attributed to Olivene (Peridote), gives just as do the impure varieties from Zoeblitz and Favero (Piedmont), mixtures very poor in peridote. To obtain it in greater abundance, magnesia must be added, the metamorphism (?) of the primitive substance having caused a loss of this earth. It will suffice then in future, when a rock that is

[1] Saemann et Pisani Sur la Cancrinite, etc., Annalles de Chimie et de Physique, 3me série, tom. 67.

under examination is supposed to belong to the peridotic type, to fuse it, and to see whether, by simple manipulations, it may be brought back to the general form of the type. It is a process which may, with great advantage, be added to the detailed or general analyses, which take up considerable time and require interpretations subject to numerous errors.

[*To be concluded in our next.*]

II.—Silliman's American Journal of Science and Arts. May, 1866.

THERE are several papers in this month's Journal of interest to Geologists.

1. *On some of the Mining Districts of Arizona near the Rio Colorado, with remarks on the climate, etc.*, by Professor B. Silliman.—(1) The San Francisco district is situated on the east side of the Colorado River, and "the observer is struck upon entering it, with the singularly wild and fantastic outline of its bounding mountains and intermediate ridges; he learns with surprise that the bold and serrated peaks stretching from east to west, and rising, now in delicate needles, and again prolonged in acute ridges, are the outcrops of gigantic quartz lodes." The lodes in general are remarkably vertical, rarely deviating more than 30° from the perpendicular. The "Moss lode" is the most important, and forms "a most conspicuous feature in the landscape, being seen, standing up in bold crests and pinnacles, from a long distance." It is composed of whitish compact felspar and quartzose porphyry, intersected by veins of red quartz and rich in free gold. (2) The Sacramento district, north-east of Fort Mojave, yields a great quantity of argentiferous galena. (3) The Irataba district, south of Fort Mojave, contains a number of veins bearing copper, but few of them appear to be worthy of exploration.

2. *On the Quaternary Formations of the State of Mississippi*, by Dr. E. W. Hilgard, State Geologist.—Besides the Alluvium proper, there are four distinct stages of the Quaternary beds recognisable in Mississippi, namely (in ascending order): (*a*) the Orange Sand, (*b*) the Bluff or Loess, (*c*) the Yellow Loam, and (*d*) the Hummocks.

The Orange Sand overlies, in many parts of the State, Sub-carboniferous, Cretaceous, and Tertiary formations, and contains fossils, mostly waterworn, derived from them; the author has failed to detect any fossils peculiar to the sand itself. Its geographical distribution, as well as the total absence of any observable dip, where its strata are sufficiently continuous to admit of such determinations, clearly prove its deposition posterior to the epoch of upheaval which has given a sensible dip even to the latest Tertiary beds of the Gulf coast; whilst its lithological characters correspond with many of the prominent features of the Drift proper of the north-western states.

The Bluff, or Loess Group, skirts the left bank of the Mississippi river, with a width inland of twelve to fifteen miles, and a maximum thickness of 75 feet. It contains the land-shells *Helix*, *Helicina*, *Pupa,* and *Achatina;* bones of the Mastodon have also been discovered in it.

The Yellow Loam overlies the Loess, where that exists, and elsewhere the Orange Sand; its average thickness is from 5 to 10 feet, and its characters vary more or less in accordance with those of the underlying material, which enters into its composition, and therefore testifies to a certain amount of denuding action.

The Hummocks, or Second Bottoms, as the newest beds are called, form part of the valleys of all the larger streams of the state, and are in general most extensive where the material of the adjoining uplands was most easily denuded, so as to permit the excavation of deep valleys; while, where that material resisted denudation, the contraction of the valley, and consequent greater swiftness of the stream, have either prevented the formation of these deposits, or caused their subsequent removal.

3. *Note on the Presence of Low Forms of Vegetation (filamentous Confervæ) in the hot and saline waters of California,* by Professor W. H. Brewer.—The waters contain a variety of salts in solution, principally sulphates of iron and alumina. The highest temperature in which the vegetation grew was about 200° F.

H. B. W.

REVIEWS.

I.—Silurian Rocks of Bohemia.

By M. J. Barrande.

[Defense des Colonies. III. Étude générale sur nos Étage G-H.; avec application speciale aux environs de Hluboçep, near Prague. Par Joachim Barrande. With a coloured Map and Plate of Sections. 8vo. Paris and Prague, 1865].

MORE than twenty-five years ago M. Barrande began a careful search in the Palæozoic strata near Prague for fossils, whereby to learn their exact relations one with another, and with like strata elsewhere. He worked on a large scale, employing native workmen to quarry the rocks and collect every fossil and fragment of fossil, keeping special note of the layer in which it occurred. Before long this steady and perfect examination of every bed enabled M. Barrande to determine several groups of so-called Silurian strata, round about Prague, arranged in a great basin or trough, and divisible into eight successive formations or stages. Three great and distinctive assemblages of animal forms (faunas) characterize the fossiliferous part of these stages. Beneath all is the old gneiss, the marble in which has lately yielded *Eozoön* to Hochstetter and Gümbel. Stages A and B, as yet unfossilliferous, are the Przibram and other Schists, and may be equivalent to the "Cambrian" of Britain, or the "Huronian" of Canada. Stage C, or the Ginetz beds, is characterized by the "Primordial Fauna" of Barrande, and is analogous