NOTICES OF MEMOIRS.

I.—On the Existence of the Mastodon in Recent Times in North America.

In his Report for 1880, Prof. John Collett, Ph.D., State Geologist of Indiana, says:—Of the thirty individual specimens of the remains of the Mastodon (*Mastodon giganteus*) found in this State, in almost every case a very considerable part of the skeleton of each animal proved to be in a greater or less condition of decay. The remains have always been discovered in marshes, ponds, or other miry places, indicating, at once, the cause of the death of the animal and the reason of the preservation of the bones from decay. Spots of ground in this condition are found at the summit of the glacial drift or in "old beds" of rivers which have adopted a shorter route and lower level, consequently their date does not reach beyond the most recent changes of the earth's surface; in fact, their existence was so late that the only query is, Why did they become extinct? A skeleton was discovered in excavating the bed of the canal a few miles north of Covington, Fountain County, in wet peat. The teeth were in good preservation, and Mr. Perrin Kent states that when the larger bones were cut open the marrow, still preserved, was utilized by the bog cutters to "grease" their boots, and that chunks of sperm-like substance, 2½in. to 3in. in diameter (adipocere), occupied the place of the kidney fat of the monster. During the past summer of 1880, an almost complete skeleton of a Mastodon was found six miles north-west from Hoopston, Iroquois County, Ill., which goes far to settle definitely that it was not only a recent animal, but that it survived until the life and vegetation of to-day prevailed. The tusks formed each a full quarter of a circle, were 9ft. long, 22in. in circumference at the base, and in their water-soaked condition weighed 175 pounds. The lower jaw was well preserved with a full set of magnificent teeth, and is nearly 3ft. long. The teeth, as usual, were thickly enamelled, and weighed each from four to five pounds. The leg bones, when joined at the knee, made a total length of 5½ft., indicating that the animal was not less than 11ft. high, and from 15 to 16ft. from brow to rump. On inspecting the remains closely, a mass of fibrous, bark-like material was found between the ribs, filling the place of the animal's stomach; when carefully separated, it proved to be a crushed mass of herbs and grasses, similar to those which still grow in the vicinity. In the same bed of miry clay a multitude of small freshwater and land shells were observed and collected, which were kindly determined by Dr. F. Stein, as follows:—1. *Pisidium*, closely resembling *P. abditum*, Haldeman. 2. *Valvata tricarinata*, Say. 3. *Valvata* resembling *V. striata*. 4. *Planorbis parvus*, Say. The shell-bearing animals prevail all over the States of Illinois, Indiana, and parts of Michigan, and show conclusively that, however other conditions may differ, the animal and vegetable life, and consequently climate, are the same now as when this *Mastodon* sank in his grave of mire and clay.—*English Mechanic*, No. 847, June 17, 1881.

II.—On the Classification and the Chronology of the Tertiary Eruptive Rocks of Hungary. By Prof. M. Szabo.

(Extracted from the "Compte rendu sténographique du Congrès internationale de Géologie," held in Paris, Aug. 29–31 and Sept. 2–4, 1878.) Imp. Nat. 1880.[1]

TO contribute to the solution of the great problem raised by the study of the eruptive rocks, I have devoted myself to the lithological and geological examination of the trachytic district of Hungary.

The first question to be solved was this : Is there a certain relation between the mineralogical constitution and the relative age of the different trachytic types?

To determine these types, I have taken as a starting-point the mineralogical association which they present, and since among their constituent elements the felspars play a predominant part, I have, in the first instance, endeavoured to establish a prompt and easy method for the determination of the different species of this group in rocks.

One of the first results of these investigations has been to show that instead of the ten series of felspars established by Tschermack, one may be contented, so far as the trachytes are concerned, with the four principal species generally recognized by the French school.

One may then distinguish in these rocks four principal types each characterized by the nature of its predominant felspathic element, viz. :—*anorthite-trachyte*, *labrador-trachyte*, *oligoclase-trachyte*, and *orthose-trachyte*.[2]

To define these different types, however, more precisely, it is needful to add to the designation of the felspar an enumeration of the principal minerals which are associated with it in each of the rocks. Thus we have :—

1. *Anorthite-pyroxene-trachyte*, characterized also by the absence of black mica and quartz ; amphibole is not excluded.

2. *Labrador-mica-trachyte*, with amphibole, with or without quartz, with or without pyroxene, and with or without garnets ; in this rock the amphibole plays a dominant part.

3. *Oligoclase-mica-amphibole-trachyte.* In this type the amphibole decreases in amount, but quartz is never absent.

4. *Orthose-mica-trachyte*, always accompanied by a triclinic felspar (generally oligoclase). Quartz is never wanting, but amphibole is often absent. These different types are not fixed ; transitions occur between them, resulting from the mixture of the felspathic species of which it is needful to take account in a more detailed description.

To appreciate the value of this classification, let us consider the relative age of the Hungarian trachytes. All geologists agree in recognizing that the phase of greatest activity in trachytic eruptions is met with in the Middle and Upper Miocene, and it is therefore possible to determine the age of the various types of these rocks in the breccias and tuffs containing characteristic fossils.

[1] Translated by Frank Rutley, F.G.S.

[2] The term orthose includes orthoclase and sanidine.

I have always noticed that the micaceous labrador-trachytes occur in the breccias containing fossils of the Middle Miocene (Mediterranean stage); the oligoclase-trachytes and the orthose-trachytes are also met with sometimes on this horizon, but never those of the anorthite-pyroxene type. This indicates that the latter types of trachyte are of later date. The trachytic tuff containing fossils of the Upper Miocene (étage Sarmatien) consists chiefly of anorthite-trachytes, but trachytes of the other types may also be recognized in it, and we may therefore conclude that this anorthite-trachyte is more recent than that containing labradorite. In order to learn the age of the oligoclase-trachytes and orthose-trachytes I have examined the oldest tuffs; and this question is now limited by reason of the discovery of trachytic fragments in the Upper Eocene deposits of Budapest, associated with the Nummulites and the other Foraminifera characteristic of this formation (étage); these trachytic fragments are orthose-trachyte. In the district of Gran, in a higher horizon, which, however, still belongs to the Upper Eocene, one meets with sheets of oligoclase-trachyte, two or three mètres in thickness, without the least trace of labrador-trachyte or of anorthite-trachyte.

The orthose-trachytes and the oligoclase-trachytes are, therefore, the oldest rocks of this eruptive series, while the anorthite-trachyte is demonstrably the most recent. As an additional proof of this it may be stated that the anorthite-trachyte traverses all the other types, but is itself cut by none of them.

These observations lead to the following important conclusions:—

1. Contact phenomena exist, and at the limit of two different types, there is sometimes a mixture of the minerals belonging to the two adjacent types.

2. The different types have undergone important modifications, which deserve special designations. It, therefore, becomes necessary to recognise a normal and a modified condition for each trachytic type; while the older the type, the more it is modified. The anorthite-trachyte is the one which most frequently occurs in a normal condition.

The principal modifications are known by the following names: *rhyolite, lithoidite, trachytic-greenstone, domite, millstone-porphyry, alunite.*

Rhyolite, accepting the term strictly in the sense in which it has been proposed by Richthofen, comprises obsidian, perlite, pitchstone, and pumice; it is formed last, during the eruption of one of the most recent types by the intervention of very fusible hydrated silicates, and it is these hydrosilicates which for the most part give rise to fluxion structure.

The presence of the rhyolitic modification is then an important character for determining relative age, for it always leaves the supposition of the existence of a more basic trachyte.

Of all the types the orthose-trachyte affords the most perfect rhyolites, the oligoclase-trachyte much less so, while the labrador-trachyte never forms either obsidian or pitchstone, but it becomes feebly perlitic and pumiceous. The anorthite-trachyte becomes merely

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pumiceous, and assumes an appearance which Beudant has designated *semi-vitreous.* It is also often possible to follow the transition from the normal to the rhyolitic condition; the amphibole and augite being the first to disappear, since they are the minerals which fuse most easily.

Of all the felspars, orthose is the most remarkable for possessing the power of undergoing hydration. This it does more easily than the soda and lime felspars; so that, in the obsidians, pitchstones, and porphyritic perlites, where we find quartz, mica, and felspar, the last is always oligoclase, while the potash is met with in the vitreous mass.

Lithoidite is the product of devitrification of the rhyolites. *Trachytic-greenstone* has a different composition, and varieties of it occur, just as the normal trachytes vary. It is possible to follow very clearly the natural transition from the normal condition of trachyte to that of greenstone. This transition results from subsequent solfataric action. The sulphurous and metallic emanations have impregnated a certain region of trachyte of one or another type, producing in it a series of changes which are still going on. The matter resulting from these changes has given rise to the formation of metalliferous lodes. The name *trachytic-greenstone* is useful and even necessary for the miner, but, for the geologist, it has no existence as a special formation; a *propylitic* eruption has never taken place.

Domite is a modification of an old type, caused by the volcanic action of a later eruption, especially by the emanations of hydrochloric acid which have removed the iron from the magnetite and the ferruginous minerals, but which has not altered the felspar, which in domite is always glassy.

Millstone-porphyry is a siliceous modification of an earlier trachytic type, which occurs either in a massive condition, or in the form of breccias or conglomerates. The millstone-porphyry of Sarospatak of Beudant, containing well-preserved sanidine and doubly-terminated pyramids of quartz, is simply breccia containing Middle Miocene fossils.

Alunite is the modification caused by emanations containing sulphuric acid, which decomposes the felspathic silicates. One always finds in the alunites masses of quartz, millstone-quartz (Silex-meulière), and if there has been a persistent disengagement of sulphuric acid, the vapour of water has carried off the alkaline sulphates, and the sulphuric acid has combined with the alumina. In this way the kaolin, which always accompanies alunite, has been formed. I have found silicified wood in the alunite deposits of Beregszaz, and the remains of Upper Miocene Molluscs at Sarospatak.

Regarding the trachytic formation as a whole, it should be considered as an eruptive unit, and may be termed a *cycle of eruption.* I am convinced that the trachytes of Hungary, those of Servia, which are but a continuation of them, as well as those of the Enganeen Hills in Italy, belong to the same cycle. They are contemporaneous, and correspond with one another. This probably

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does not hold good for the trachytes of Auvergne, and for those of the Grecian Islands, where much more recent cycles of eruption have occurred.

These cycles of eruption may also be followed back into earlier times, into the Secondary epoch, or into the Palæozoic ages, and I have already satisfied myself that the series of felspathic rocks at different periods is often the same.

The basalt of Hungary seems to be an episode of the great trachytic formation, derived from a lower horizon, but nevertheless related to the trachytes. In Hungary the basaltic eruption has terminated the volcanic action, during and even after the deposition of the *couches à congéries* (Pliocene).

The anorthite-trachyte forms more than 50 per cent. of the trachytic mass; the labrador-trachyte 30 per cent., the oligoclase-trachyte 15 per cent., and lastly the orthose-trachyte 5 per cent. The first of these is, therefore, the most important, inasmuch as it still forms the highest trachytic mountains of the district (sometimes with an elevation of over 6000 feet); moreover we may for the most part attribute to it those secondary actions which have modified the other types.

REVIEWS.

I.—NOTE-BOOK OF AN AMATEUR GEOLOGIST. By JOHN EDWARD LEE. pp. 90; 209 Plates. (London: Longmans, Green, & Co., 1881.)

WE must confess to some disappointment in turning over the pages of this work, but our disappointment is caused by what is generally considered to be a fault on the right side, inasmuch as the author in his text has given us far too little of his personal experiences. Few men have seen more than Mr. Lee of sections and districts that have been rendered famous by the descriptions given of them by our leading geologists; and if he has for the most part followed in the footsteps of others, he has himself rendered good service to science by the magnificent collections he has made. In his museum are included not a few specimens new to science, and many others personally obtained, which have enlarged our knowledge of the fossil fauna and flora of particular districts. Some of them are shown in the plates now before us. Nor can we contemplate the illustrations which form the bulk of this work, without a feeling of reverence, taking us back as they do fifty years or more, when the study of geology was cultivated by the few, mostly men of means and position.

The author speaks with affectionate regard of John Phillips, to whom he owed his earliest geological lessons, and in whose company he spent many of the happiest hours of his life. In the preface to his work on the Palæozoic Fossils of Cornwall, Devon, and West Somerset (1841), Professor Phillips acknowledges the assistance he had received from Mr. Lee, who had at that time laboured very

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