substitute for an evaluation of all characters, taken in conjunction with stratigraphical evidence, in making a classification. He has repeated what he has said in previous works, but he has not advanced any new evidence to convince more conservative palaeontologists that septa, any more than any other single character, are the kèy to ammonite phylogeny.

D. T. DONOVAN.

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ULTRABASIC PILLOW LAVAS FROM CYPRUS

SIR,—Mr. D. W. Bishopp, who initiated the Cyprus Geological Survey in September, 1950, published the following papers on the Troodos Massif:—

"The Troodos Massif," *Nature*, vol. 169, No. 4299, 22nd March, 1952.

"Some new features of the Geology of Cyprus," XIX Intern. Geol. Cong., Algiers, 1952.

Much of the preliminary reconnaissance work in the Troodos area, as well as some detailed mapping, was undertaken by Mr. Bishopp. I regret therefore that in the brief history of the Cyprus Geological Survey, given in the introduction of my paper, Mr. Bishopp's contribution was not sufficiently acknowledged and also his two papers were not given as references.

The bulk of Mr. Bishopp's letter concerns the Diabase Formation and as my colleagues Mr. L. M. Bear and Mr. R. A. M. Wilson are more familiar with these rocks I prefer to leave any description and discussion to them. Memoirs by Bear and Wilson, based on detailed mapping of parts of the Troodos Massif, are due to be published in the near future; both put forward evidence in favour of an intrusive origin for most of the Diabase Formation.

I. G. GASS.

GEOLOGICAL SURVEY DEPT.,
NICOSIA,
CYPRUS.
15th January, 1959.

THE VISCOSITY OF ROCK-GLASS OF GRANITIC COMPOSITION UNDER VARIOUS PHYSICAL CONDITIONS: A CORRECTION AND AN ADDENDUM

SIR,—In a recent paper on "Granite: some tectonic, petrological and physico-chemical aspects," published in this Magazine (1958, pp. 378–396) I referred on p. 393 to Saucier's determination of the viscosity of rétinite (a variety of pitchstone) under pressure of gaseous water. Saucier found the viscosity to be 10^7 poises at 980° C. with a pressure of gaseous water of 160 bars. Through some error this pressure is wrongly recorded in my paper as 750 bars; the mistake does not alter the conclusions.

Dr. Saucier has kindly drawn my attention to further important investigations of the viscosity of rétinite by his colleague Sabatier (1956). The results of these experiments are of particular interest because they provide a measure of the effects both of increasing pressure of gaseous water and of increasing temperature in lowering the viscosity of natural pitchstone. The following three series of viscosity determinations were made by Sabatier: (1) Nine determinations made at atmospheric pressure under dry conditions showed that viscosity decreased from nearly 10^{12} poises to slightly less than 10^{10} poises as the temperature increased from 900° C. to 1,060° C.; (2) Five determinations made at 500 bars, with a mean content of about 5 per cent water, showed a decrease from nearly 10^{10} poises to slightly less than 10^{9} poises as the temperature increased from 700° C. to 750° C.; (3) Six determinations at 1,000 bars, with a mean content of about 6 per cent water, showed a decrease from slightly less than 10^{9} poises to slightly less than 10^{7} poises as the temperature increased from 650° C. to 790° C.

Sabatier's experimental results relate to pitchstone which is chemically related to the minimites in Bowen and Tuttle's experimentally investigated synthetic haplo-pitchstones. His results indicate that at 1,000 bars and a temperature between 700° C. and 750° C., conditions under which Bowen and Tuttle's experimental minimite begins to crystallize, the viscosity is of the order of 10^{8} or 10^{7} poises. For melts of minimite composition, with a temperature no greater than 800° C., to have a viscosity as low as that of basaltic melt at 1,400° C., i.e. 10^{2} poises (Kani, 1934), a pressure of gaseous water of the order of 5,000 bars is necessary, i.e. a pressure corresponding to that of the overhead weight of rocks at depths of 10 miles. Only with temperatures of the order of 1,200° C. would the viscosity of melts of minimite composition be reduced to 10^{2} poises or less at a pressure of 1,000 bars (equivalent to the overhead weight of rocks at a depth of about 2 miles).

Even though its viscosity be no more than 10^{2} poises, however, basalt magma does not form net-veins. It thus emerges that Sabatier's viscosity determinations unite with the geological evidence (Reynolds, 1954) in indicating that, at the time of intrusion, the physical state of microgranite (including granophyre) emplaced as net-veins differed from that implied by the normal usage of the term " magma ". If liquid magma were more than saturated with water foam would form and the result would be to increase the viscosity; the fact that foam is highly viscous compared with either of its phases is commonly overlooked. The evidence suggests that the highly mobile antecedent of the microgranite of net-veins was either (1) gaseous, or (2) a disperse system with gas, the continuous phase, acting as transporting agent, i.e. spray. In the latter event, if the temperature were such that the droplets were liquid (saturated with water) a variety of ignimbrite would be expected to remain after escape of the gaseous transporting agent. Ignimbrite does, in fact, occur as net-veins in Ardnamurchan (Reynolds, 1951, 1954, plate 1, p. 590). Furthermore, ignimbrite, like the powdered synthetic glass used in hydrothermal synthesis by Bowen and Tuttle, may be equally expected to devitrify or crystallize under appropriate physical conditions.

Geologists have long been puzzled by the seeming contradiction between (1) the high viscosity of recent acid lavas, which characteristically form tholoids and spines, and (2) the extremely low viscosity implied by the wide areal extent of many pre-historic acid extrusive rocks that were originally described as obsidians and rhyolites. Re-examination of such obsidians and rhyolites of a wide variety of ages and in many countries (including Britain) is increasingly revealing that they are ignimbrites, i.e. they were erupted as " fiery showers ". Reference to one of these recent discoveries of ignimbrite is highly relevant to current discussions concerning the antecedents of granophyre. Over twenty years ago von Eckermann (1936) recorded gradations from felsitic porphyries to granophyres within lava-flows (Dala porphyries) of Precambrian age in central Sweden. Not only does gradation from felsite to granophyre take place through series of progressively older flows, it also occurs within single flows. In examples of the latter spherulitic felsite forms the upper part of a flow and grades downwards into typical granophyre towards the base. In the felsitic portions of some of these flows Hjelmqvist (1956) has recently recognized the diagnostic characteristics of ignimbrite. Even where devitrification has occurred the outlines of the original glass-shards are commonly preserved with the same clarity as in the type ignimbrites from New Zealand (Marshall, 1935). Although unrecognized, and understandably so, at the time when von Eckermann described these rocks, ignimbrites are well represented in the excellent photographs illustrating his Memoir (von Eckermann, 1936, Plate LXIX, fig. 2; Plate LXXI, figs. 1 and 2; Plate LXXII). Here then is evidence that sheets of granophyre are crystallized ignimbrites; Bowen and Tuttle's experimental results, combined with Sabatier's viscosity determinations, provide evidence concerning the physical conditions under which this could happen without true liquefaction.

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DORIS L. REYNOLDS.

GRANT INSTITUTE OF GEOLOGY,
WEST MAINS ROAD,
EDINBURGH, 9.

22nd January, 1959.

MONOGRAPTUS TRIANGULATUS

SIR,—In my paper, " Triangulate Monograptids from the *Monograptus gregarius* zone (Lower Llandovery) of the Rheidol Gorge (Cardiganshire)," *Phil. Trans. Roy. Soc. Lond.*, B, 241, 485–555, 1958, I established the new species *Monograptus separatus* for a group of forms with rastritiform proximal thecae and triangular distal ones. Seven subspecies were distinguished, depending mainly on the number and nature of the proximal rastritiform thecae present; these were *Monograptus separatus separatus* Sudbury, *M. separatus fimbriatus* (Nicholson), *M. separatus similis* (Elles and Wood), *M. separatus predecipiens* Sudbury, *M. separatus triangulatus* (Harkness), *M. separatus major* (Elles and Wood) and *M. separatus extremus* Sudbury. My work suggested an evolutionary series in which *M. separatus separatus* was the first member and continued as the main stock, and for this reason the group as a whole was given this name.

It has been pointed out to me that according to the Rules of Zoological Nomenclature such a group must always be known by the oldest name available from among those of its members. Thus the species *Monograptus separatus* Sudbury, 1958, should be called *Monograptus triangulatus* (Harkness) 1851, and the type of the group as a whole is the specimen figured by Harkness as *Rastrites triangulatus*, Plate I, fig. 3*a* (? 3*b*) in his paper " Description of the Graptolites found in the Black Shales of Dumfriesshire ", *Quart. Journ. Geol. Soc.*, vii, 58–65. The changes of name thus required for the subspecies are listed below:—