	I.	II.	III.	IV.	V.	VI.
SiO_2	55·02	53·28	46·06	45·17	46·48	42·25
Al_2O_3	20·42	16·38	17·04	14·78	16·16	16·26
Fe_2O_3	3·06	6·11	4·01	5·10	6·17	8·43
FeO	1·82	4·52	4·51	5·05	6·09	5·46
MgO	0·59	2·50	3·15	6·26	4·02	5·49
CaO	1·67	3·09	7·43	11·06	7·35	9·75
Na_2O	8·63	6·42	7·13	3·69	5·85	4·45
K_2O	5·38	4·18	2·98	2·73	3·08	1·92
H_2O+	} 2·77	3·52	3·32	} 3·40	4·27	2·43
H_2O-			0·70			
CO_2	—	—	1·18	—	0·45	—
TiO_2	—	—	3·15	—	0·99	2·52
P_2O_5	0·06	0·15	0·23	0·51	—	1·04
MnO	0·22	—	—	0·35	—	—
Totals	100·00	100·15	100·89	100·00	100·91	100·00
(I) Magmatic Symbols	II, 6, 1, 4	II, 6, 1, 4	II, 6, 2, 4	III, 6, 2, 4	III, 6, 2, 4	III, 6, 3, 4
and Names	Laurdalose.		Essexose.	Monchiquose.		Limburgose.

I. Average of fifteen analyses of *Tinguaite* after Daly, *Igneous Rocks*, 1914, p. 35.

II. *Ulrichite* (Camptonitic tinguaite). Dunedin, New Zealand. P. Marshall, Q.J.G.S., lxii, p. 397, 1906.

III. *Nepheline monchiquite*. 20 kilometres north-east of Senza do Itombe, Angola. Arthur Holmes, analyst.

IV. Average of sixteen analyses of *Olivine monchiquite*, after Daly, *Igneous Rocks*, 1914, p. 36.

V. *Olivine monchiquite*. Cabo Frio, Brazil. Hunter and Rosenbusch, *Min. pet. Mitth.*, xi, p. 445, 1890. M. Hunter, analyst.

VI. Average of six analyses of *Augitite*, after Daly, *Igneous Rocks*, 1914, p. 30.

(*To be concluded in our next number.*)

NOTICES OF MEMOIRS.

A Discussion upon the Age of the Lower Tertiary Marine Rocks of Australia.[1]

By R. Bullen Newton, F.G.S.

THE author referred briefly to the valuable palæontological work on the Australian Tertiaries carried out by such prominent authors as M'Coy, Ralph Tate, Dennant, Hall, Pritchard, etc., the majority of whom favoured an Eocene age for the Lower Tertiary deposits of Australia. The late G. F. Harris doubted the existence of such a formation, whilst M. Cossmann could see no relationships among the Lower Tertiary Opisthobranchs from Australia with Eocene forms from Europe.

Mr. F. Chapman, Palæontologist of the Melbourne Museum, has studied this subject, and proves very conclusively that those beds hitherto regarded as Eocene belong to the Miocene period—a view

[1] From Reports of the Eighty-fourth Meeting British Association for the Advancement of Science, Australia, 1914, published 1915, p. 375.

which the author fully supports. Mr. Chapman's work on the Batesford Limestone is important in this connexion, because of its containing *Lepidocyclina*, *Amphistegina*, and *Lithothamnium*—all of which characterize the Miocene beds of Europe, Java, Sumatra, Borneo, Formosa, etc.; the absence of nummulites in this limestone is against its age being either Eocene or Oligocene. These same limestones have also yielded Mollusca and Brachiopoda, as well as *Carcharodon megalodon*, which has its origin in Miocene rocks. The author was of opinion that the Lower Tertiary faunas of Australia presented in some cases a recent facies, in others a Miocene facies, with relationships to both European and South American species of that period. Among shells showing a resemblance to those of present-day seas, he mentioned *Cassis contusus*, *Siphonalia spatiosa*, *Typhis laciniatus*, all Tate's species, and mostly from the Muddy Creek deposits; and many more species might be quoted exhibiting a more or less recent appearance. Among fossil forms more particularly referred to was the *Aturia aturi*, var. *australis*, which has been recognized as coming from the Eocene of Australia. Although given a varietal name, this Cephalopod is not to be separated from the Miocene species of Europe known as *Aturia aturi*, and with this statement Mr. Crick, of the British Museum, thoroughly agrees. The species is found in many of the Australian deposits, as also in the Table Cape Beds of Tasmania, the Oamaru Beds of New Zealand, the Navidad Beds of Chili, South America, as also in the European Miocene. The more or less pointed rostrum of *Spirulirostra curta* illustrates an affinity with Miocene forms rather than with Eocene, which are more obtuse.

The large *Cypræas* described by M'Coy as Oligocene should more probably be regarded as Miocene, since they come from the Gellibrand River Beds, Muddy Creek deposits, etc., which also contain the *Aturia aturi* before mentioned. The Brachiopods of the Lower Tertiary deposits of Australia show a somewhat recent facies, a striking form being *Magellania garibaldiana*—a species occurring in the Mount Gambier Beds in association with the *Aturia aturi*.

Even before Mr. Chapman pointed out the Miocene characters of the Lower Tertiary deposits of Australia, Dr. Ortmann, of the United States, had published in 1902 his important monograph on *The Tertiary Deposits of Patagonia*, in which he compared the faunas of that continent with those of Australia. His researches were against the presence of Eocene in the Tertiaries of Australasia, and those beds hitherto recorded as such he identified as Miocene, and contemporaneous with the Pareora Beds of New Zealand, Navidad Series of Chili, and the Patagonian deposits, all of which showed unmistakable affinities with each other and favoured the view that a former connexion existed between South America and Australasia.

The term Oligocene among Australasian marine Tertiaries, the author was inclined to abandon because of the absence of *Nummulites*, their place being taken by *Amphistegina* and Lepidocycline forms of Foraminifera. Such rocks he would regard as Miocene. This would apply to the Balcombian and Janjukian Beds of Mornington, etc., and the older deposits of Muddy Creek and other localities.