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Quod si cui mortalium cordi et curæ sit non tantum inventis hæerere, atque iis uti, sed ad ulteriora penetrare; atque non disputando adversarium, sed opere naturam vincere; denique non belle et probabiliter opinari, sed certo et ostensive scire; tales, tanquam veri scientiarum filii, nobis (si videbitur) se adjungant.  
—*Novum Organum, Præfatio.*

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## TABLE OF CONTENTS.

---

### PART I.—ORIGINAL COMMUNICATIONS.

	Page
ADAMS, Dr. A. L. On the Geology of a Portion of the Nile Valley north of the Second Cataract in Nubia; with a Note on the Shells, by S. P. WOODWARD, Esq., F.G.S., A.L.S.; and a Note on some Teeth of <i>Hippopotamus</i> , by Dr. H. FALCONER, F.R.S., F.G.S. ....	6
AUSTIN, Fort-Major T. On the Earthquake which occurred in England on the morning of October 6th, 1863. [Abstract.] ..	380
BELT, T., Esq. On the Formation and Preservation of Lakes by Ice-action. [Abstract.].....	463
BIGSBY, Dr. J. J. On Missing Sedimentary Formations, from Suspension or Removal of Deposits .....	198
BLAKE, W. P., Esq. On the Geology and Mines of the Nevada Territory (Washoe Silver Region), U. S. ....	317
BULLOCK, Capt. On some Fossils from Japan. [Abstract.].....	44
CODRINGTON, T., Esq. On a Section with Mammalian Remains, near Thame.....	374
DAWKINS, W. BOYD, Esq. On the Rhætic Beds and White Lias of Western and Central Somerset, and on the discovery of a new Fossil Mammal in the Grey Marlstones beneath the Bone-bed..	396
DUNCAN, Dr. P. MARTIN. On the Fossil Corals of the West Indian Islands. Part II. (With 4 Plates.) .....	20
———. ———. Part III. ....	358
EGERTON, Sir P. de M. G. On some Ichthyolites from New South Wales, forwarded by the Rev. W. B. CLARKE, M.A., F.G.S. (With 1 Plate.) .....	1
EVANS, J., Esq. On some recent Discoveries of Flint Implements in Drift Deposits in Hants and Wilts .....	188
———. On some Bone- and Cave-deposits of the Reindeer-period in the South of France. [Abstract.] .....	444
FARREN, J. W., Esq. On the recent Earthquake at Manila. [Abstract.] .....	117

	Page
GODWIN-AUSTEN, Capt. On the Geology of Part of the North-Western Himalayas; with Notes on the Fossils by Mr. T. DAVIDSON, Mr. R. ETHERIDGE, and Mr. S. P. WOODWARD. [Abstract.] .....	383
HARKNESS, Prof. R. On the Reptiliferous Rocks and the Footprint-bearing Strata of the North-East of Scotland .....	429
HAUGHTON, The Rev. Prof. S. On the Granites of Ireland. Part IV. On the Granites and Syenites of Donegal; with some Remarks on those of Scotland and Sweden .....	116, 268
HELMERSEN, Prof. J. On the Carboniferous Rocks of the Donetz, and on the Granite and Granitic Detritus of the neighbourhood of St. Petersburg. [Abstract.].....	444
HIND, Prof. H. Y. On supposed Glacial Drift in the Labrador Peninsula, Western Canada, and on the South Branch of the Saskatchewan .....	122
HISLOP, The Rev. S. On the further Discovery of Fossil Teeth and Bones of Reptiles in Central India.....	117, 280
HOLL, Dr. H. B. On the Geological Structure of the Malvern Hills and adjacent district. [Abstract.] .....	413
HONEYMAN, The Rev. D. On the Geology of Arisaig, Nova Scotia.	333
HULL, E., Esq., and A. H. GREEN, Esq. On the Millstone-grit of North Staffordshire and the adjoining parts of Derbyshire, Cheshire, and Lancashire. (With 1 Plate.) .....	242
HUXLEY, Prof. T. H. On the Cetacean Fossils termed " <i>Ziphius</i> " by Cuvier; with a Notice of a new Species ( <i>Belemnoziphius compressus</i> ) from the Red Crag. (With 1 Plate.) .....	388
JENKINS, H. M., Esq. On some Tertiary Mollusca from Mount Séla, in the Island of Java; with a Description of a new Coral from the same locality, and a Note on the Scindian Fossil Corals, by P. M. DUNCAN, M.B., F.G.S. (With 2 Plates.) .....	45
KIRKBY, J. W., Esq. On some Remains of Fish and Plants from the "Upper Limestone" of the Permian Series of Durham. (With 1 Plate.) .....	345
KÖENEN, The Baron A. von. On the Correlation of the Oligocene Deposits of Belgium, Northern Germany, and the South of England .....	97
LANKESTER, E. RAY, Esq. On the Discovery of the Scales of <i>Pteraspis</i> , with some Remarks on the Cephalic Shield of that Fish. (With 1 Plate.) .....	194
LECKENBY, J., Esq. On the Sandstones and Shales of the Oolites of Scarborough, with Descriptions of some new Species of Fossil Plants. (With 4 Plates.).....	74
LENNOX, A., Esq. On the White Limestone of Jamaica, and its associated intrusive Rocks. [Abstract.].....	380
MAW, G., Esq. On the Drift-deposits of the Severn, in the Neighbourhood of Coalbrook Dale and Bridgnorth .....	130
———. On a supposed Deposit of Boulder-clay in North Devon. [Abridged.] .....	445

TABLE OF CONTENTS.

v

	Page
MURCHISON, Sir R. I., and Prof. R. HARKNESS. On the Permian Rocks of the North-West of England, and their Extension into Scotland .....	144
POOLE, G. S., Esq. On the Recent Geological Changes in Somerset, and their Date relatively to the Existence of Man and of certain Extinct Mammalia. [Abstract.] .....	118
POWRIE, J., Esq. On the Fossiliferous Rocks of Forfarshire and their Contents. (With 1 Plate.) .....	413
ROBERTS, G. E., Esq. On some Remains of <i>Bothriolepis</i> from the Upper Devonian Sandstones of Elgin. [Abstract.] .....	198
SALTER, J. W., Esq. On some new Fossils from the Lingula-flags of Wales. (With 1 Plate.) .....	233
SEELEY, H., Esq. On the Ammonites of the Cambridge Greensand. [Abstract.] .....	166
———. On the Hunstanton Red Rock. [Abstract.] .....	327
SWAN, W. R., Esq. On the Devonian Rocks of the Bosphorus. . . .	114
TATE, R., Esq. On the Liassic Strata of the Neighbourhood of Belfast: with Descriptions of new Species of Mollusca, &c., by R. ETHERIDGE, Esq., F.G.S., F.R.S.E. ....	103
VICARY, W., Esq. On the Pebble-bed of Budleigh Salterton; with a Note on the Fossils, by J. W. SALTER, Esq., F.G.S., A.L.S. (With 3 Plates.) .....	116, 283
WINTLE, S. H., Esq. On the Principal Geological Features of Hobart, Tasmania. [Abridged.] .....	465
WITCHELL, E., Esq. On a Deposit at Stroud containing Flint Implements, Land and Freshwater Shells, &c. [Abstract.] .....	378
WOOD, S. V., jun., Esq. On the Structure of the Red Crag in Suffolk and Essex. [Abstract.] .....	121
WRIGHT, Dr. T. On the Fossil <i>Echinide</i> of Malta; with Notes on the Miocene Beds of the Island, and on the Stratigraphical Distribution of the Species therein, by Dr. A. LEITH ADAMS. (With 2 Plates.) .....	470
WYATT, J., Esq. On further Discoveries of Flint Implements and Fossil Mammals in the Valley of the Ouse .....	183
YOUNG, Dr. J. On the Former Existence of Glaciers in the High Grounds of the South of Scotland. ....	452

---

Annual Report .....	i
Anniversary Address .....	xxxiii
List of Foreign Members .....	xxiii
List of the Wollaston Medalists .....	xxiv
Donations to the Museum and Library (with Bibliography)	
	xv, 83, 168, 303, 492

## EXPLANATION OF THE PLATES.

PLATE			
I.	{	ICHTHYOLITES FROM NEW SOUTH WALES, to illustrate Sir P. de M. Grey Egerton's paper on some Ichthyolites from New South Wales, forwarded by the Rev. W. B. Clarke... <i>to face page</i>	4
II.	{	WEST INDIAN FOSSIL CORALS, to illustrate Dr. P. M. Duncan's paper on the Fossil Corals of the West Indian Islands. Part II.	44
III.	{		
IV.	{		
V.	{		
VI.	{	JAVAN FOSSILS, to illustrate Mr. Jenkins's paper on some Tertiary Mollusca from Mount Séla, in the Island of Java; with a Description of a new Coral from the same locality, and a Note on the Scindian Fossil Corals, by Dr. P. Martin Duncan.	73
VII.	{		
VIII.	{	OOLITIC PLANTS FROM SCARBOROUGH, to illustrate Mr. Leckenby's paper on the Sandstones and Shales of the Oolites of Scarborough, with Descriptions of some New Species of Fossil Plants	82
IX.	{		
X.	{		
XI.	{		
XII.	{	PTERASPIS AND CEPHALASPIS, to illustrate Mr. E. Ray Lankester's paper on the Discovery of the Scales of Pteraspis, with some remarks on the Cephalic Shield of that fish.....	197
XIII.	{	LOWER LINGULA-FLAGS FOSSILS, to illustrate Mr. J. W. Salter's paper on some new Fossils from the Lingula-flags of Wales	241
XIV.	{	GEOLOGICAL SKETCH-MAP OF NORTH STAFFORDSHIRE, to illustrate Messrs. Hull and Green's paper on the Millstone-grit of North Staffordshire and the adjoining parts of Derbyshire and Lancashire	242
XV.	{	BUDLEIGH SALTERTON FOSSILS, to illustrate Mr. W. Vicary's paper on the Pebble-bed of Budleigh Salterton; with a Note on the Fossils, by Mr. J. W. Salter.....	302
XVI.	{		
XVII.	{		
XVIII.	{	PERMIAN FISHES, to illustrate Mr. Kirkby's paper on some Remains of Fish and Plants from the "Upper Limestone" of the Permian Series of Durham	358
XIX.	{	BELEMNOZIPHIUS COMPRESSUS, <i>Huxley</i> , to illustrate Prof. Huxley's paper on the Cetacean Fossils termed "Ziphius" by Cuvier, with a Notice of a New Species from the Red Crag...	396
XX.	{	DEVONIAN FISHES FROM FORFARSHIRE, to illustrate Mr. Powrie's paper on the Fossiliferous Rocks of Forfarshire and their Contents	429
XXI.	{	ECHINODERMS FROM MALTA, to illustrate Dr. Wright's paper on the Fossil Echinidæ of Malta; with additional Notes on the Miocene Beds of the Island, and the Stratigraphical Distribution of the Species therein, by Dr. A. Leith Adams	491
XXII.	{		

## LIST OF THE FOSSILS FIGURED AND DESCRIBED IN THIS VOLUME.

[In this list, those fossils the names of which are printed in Roman type have been previously described.]

Name of Species.	Formation.	Locality.	Page.
PLANTÆ. (24.)			
<i>Calamites arenaceus</i> ? .....	Permian .....	Fulwell .....	357
<i>Ctenis Leckenbyi</i> . Pl. x. f. 1a, 1b ...	Lower Oolitic	Scarborough ...	78
<i>Cycadites zamioides</i> . Pl. viii. f. 1.....	Lower Oolitic	Scarborough ...	77
<i>Dædalus</i> ? .....	Silurian .....	{ Budleigh Sal- terton. }	288
<i>Fucoides erectus</i> . Pl. xi. f. 3a, 3b ...	} Lower Oolitic	} Scarborough	81
<i>Neuropteris arguta</i> . Pl. x. f. 4.....			79
<i>Otopteris graphica</i> . Pl. viii. f. 5.....			78
— <i>lanceolata</i> . Pl. viii. f. 4 .....			78
— <i>mediana</i> . Pl. x. f. 2.....			78
— <i>tenuata</i> . Pl. ix. f. 1.....			79
<i>Palæozamia pecten</i> . Pl. ix. f. 4 .....			77
<i>Pecopteris polydactyla</i> . Pl. xi. f. 1a, 1b .....			80
<i>Phlebopteris propinqua</i> .....			80
— <i>Woodwardi</i> . Pl. viii. f. 6 .....			81
<i>Pterophyllum angustifolium</i> . Pl. viii. f. 3 .....			77
— <i>comptum</i> . Pl. ix. f. 3 .....			77
— <i>medianum</i> . Pl. viii. f. 2 .....			77
— <i>minus</i> . Pl. ix. f. 2 .....			78
<i>Sphenopteris Jugleri</i> .....			79
— <i>modesta</i> . Pl. x. f. 3a, 3b.....			79
<i>Tympanophora simplex et racemosa</i> . Pl. xi. f. 2 .....	} Permian .....	} Fulwell .....	79
<i>Ulmannia selaginoides</i> .....			356
— sp. ? .....			357
<i>Vexillum</i> ? .....	Silurian .....	{ Budleigh Sal- terton. }	288
PROTOZOA.			
<i>Protospongia fenestrata</i> . Pl. xiii. f. 12	Lower Lingula	Solva Harbour	238

Name of Species.	Formation.	Locality.	Page.
MOLLUSCA. (49.)			
(Brachiopoda.)			
<i>Leptæna Vicaryi</i> . Pl. xvii. f. 16, 17...	Lower Silurian	Budleigh Salterton.	296
<i>Lingula Lesueuri</i> . Pl. xvii. f. 1. ....			292
— <i>Brimonti</i> . Pl. xvii. f. 6. ....			294
— <i>Hawkei</i> . Pl. xvii. f. 2, 3. ....			293
— <i>Rouaulti</i> . Pl. xvii. f. 4, 5. ....			293
<i>Orthis pulvinata</i> . Pl. xvii. f. 8. ....			294
— <i>redux</i> . Pl. xvii. f. 7. ....			294
— <i>redux</i> , var. Pl. xvii. f. 7d. ....			294
<i>Porambonites</i> , sp. Pl. xvii. f. 9. ....			295
<i>Rhynchonella</i> , sp. Pl. xvii. f. 15. ....			296
—, sp. Pl. xvii. f. 14. ....			297
<i>Spirifer antiquissimus</i> . Pl. xvii. f. 10-12			295
— <i>Davidis</i> . Pl. xvii. f. 13. ....			296
(Lamellibranchiata.)			
<i>Arca</i> ? <i>Naranjoana</i> ? Pl. xvi. f. 8. ....	Lower Silurian...	Budleigh Salterton	300
<i>Astarte dentilabrum</i> . Woodcut, f. 5-7	Lower Lias. ....	Larne Lough. ....	112
<i>Cardium subalternatum</i> . Pl. vii. f. 7a, 7b	.....	Mount Séla, Java	60
<i>Ceromya gibbosa</i> . Woodcut, f. 3, 4. ....	Lower Lias. ....	Larne Lough. ....	112
<i>Clidophorus</i> ? <i>amygdalus</i> . Pl. xvi. f. 6	Lower Silurian	Budleigh Salterton.	298
<i>Ctenodonta</i> <i>Bertrandi</i> . Pl. xv. f. 8. ....			301
<i>Hippomya ringens</i> . Pl. xv. f. 7. ....			299
<i>Lyrodesma calata</i> . Pl. xvi. f. 7. ....			300
<i>Modiolopsis obliquus</i> . Pl. xvi. f. 3a-3c			298
— <i>Armorici</i> . Pl. xvi. f. 1, 1a. ....			297
— <i>lingualis</i> . Pl. xvi. f. 5. ....			298
— <i>liratus</i> . Pl. xvi. f. 4. ....			297
—, sp. Pl. xvi. f. 2. ....			298
<i>Orthonota Grammysioides</i> . Pl. xvi. f. 10. ....			300
<i>Palæarca secunda</i> . Pl. xvi. f. 9. ....			300
<i>Pseudaxinus trigonus</i> . Pl. xv. f. 6. ....			299
<i>Pythina Semperi</i> . Pl. vii. f. 8a, 8b. ....			Tertiary. ....
<i>Solen</i> ? Pl. xvi. f. 11. ....	Lower Silurian. ....	Budleigh Salterton	301
<i>Tellina</i> , sp. ....	Tertiary. ....	Mount Séla, Java. ....	61
(Gasteropoda.)			
<i>Conus striatellus</i> . Pl. vii. f. 3a, 3b. ....	Tertiary. ....	Mount Séla, Java. ....	54
<i>Dentalium minimum</i> . ....	Lias. ....	Larne Lough. ....	111
<i>Murex Grooti</i> . Pl. vi. f. 1a, 1b. ....	Tertiary. ....	Mount Séla, Java	51
—? <i>paradoxicus</i> . Pl. vi. f. 2a, 2b. ....			51
—, sp. ....			52
<i>Natica Duncanii</i> . Pl. vi. f. 6. ....			55
— <i>Flemingiana</i> ? Pl. vi. f. 7. ....			57
— <i>rostralina</i> . Pl. vi. f. 8. ....			56
<i>Oliva utriculus</i> . Pl. vii. f. 4. ....			54
<i>Purpura umbilicata</i> . Pl. vi. f. 5a, 5b. ....			53
<i>Pyruca cochlidium</i> . Pl. vi. f. 4. ....			52
— <i>Javanis</i> . Pl. vi. f. 3a, 3b. ....			53
<i>Turbo obliquus</i> . Pl. vii. f. 6. ....			59
<i>Turritella acuticingulata</i> . Pl. vii. f. 1			58
— <i>simplex</i> . ....			59
<i>Vicarya</i> ? <i>callosa</i> . Pl. vii. f. 5. ....	57		

'Algerine,' and of Mr. James H. Kerr, of H.M.S. 'Actæon,' and the useful assistance of his friend Tskahara, a Japanese officer attached to the 'Dove.' The specimens obtained\* were collected in Japan during the year 1861, and were forwarded, with a few notes on, and sketches of, the localities, to the Geological Society through Sir R. I. Murchison.

The chief locality is Fossil Point, Tanabe, which district the author designates the "Italy of Japan"; he remarks that the cape of Tanabe is formed by a range of hills rising in ridges to a height of 590 feet, and intersected by deep ravines. On the sea-coast the rock is everywhere sandstone, and the reefs abounding in the bay are composed of the same rock; but he mentions a particular cave, at an altitude of 350 feet, which was in a hard, black, and lichen-covered limestone. Wherever the stratification was observed it was horizontal.

The cape is further described as bordered by a plain, but a few miles inland the mountains rise to a height of from 2000 to 4000 feet; the hills on the coast are low and undulating, and the sea-shores are formed chiefly of iron-bound cliffs.

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3. *On some TERTIARY MOLLUSCA from MOUNT SÉLA, in the ISLAND of JAVA.* By H. M. JENKINS, Esq., F.G.S., Assistant-Secretary of the Geological Society. *With a DESCRIPTION of a new CORAL from the same locality, and a NOTE on the SCINDIAN FOSSIL CORALS;* by P. MARTIN DUNCAN, M.B., F.G.S.

[PLATES VI. & VII.]

CONTENTS.

I. Introduction.	poraneity of Tertiary Formations.
1. Bibliography of Javan Geology.	2. Percentage of Recent Species.
2. Geology of the Mount-Séla District.	3. Affinities of the new Species.
3. Remarks on the new Species.	4. Nummulitic Formation of India (including a Note on the Scindian Fossil Corals, by Dr. Duncan).
II. Description of the Species.	5. Evidences of Physical Conditions.
III. Conclusion.	6. Age of the Tertiary Formation of Java.
1. Emigration eastwards of the European Miocene Fauna and its influence on the contem-	

§ I. INTRODUCTION.

1. *Bibliography of Javan Geology.*—Until very recently the Island of Java, notwithstanding its having been a Dutch colony for more than a century and a half, was almost a *terra incognita* to the geologist, the only familiar fact relating to its geology being that it

\* The specimens are in the Society's Museum; they consist of pieces of sandstone, containing a few species of the genera *Turritella*, *Cancellaria*, *Murex*, *Arca*, *Cytherea*, *Cardium*, &c., the shelly matter of which has been in every case replaced by gypsum. As regards their probable age see p. 63, footnote.—EDIT.



possessed a large number of volcanos, some of very great size. Even now, very little has been published concerning its geology and palæontology, although several collections of rocks and fossils have been brought or sent from thence to Europe, so that this paucity of information is to be attributed more to the absence of published descriptions than to the want of materials.

Mijnheer Junghuhn, whose admirable work on the Physical Features, Botany, and Geology of Java\* is most elaborate, sent to Leijden a large collection of rocks and fossils in illustration of the volume devoted to geology. The description of the fossils (except the Plants) was entrusted to Mijnheer Herklots, who published, in 1854, under the auspices of the Dutch Government, the "Fourth Part" (although really the first, being the only one as yet published) of a large work †, which promises to be, when completed, a most valuable addition to our knowledge of the palæontology of the Eastern Archipelago. The same author is at present engaged upon the Gasteropods contained in M. Junghuhn's collection, and this second instalment will probably appear in the course of next year. The description of the fossil Plants, by Dr. H. R. Goepfert ‡, was also published in 1854, with the aid of the Dutch Government.

The conclusions arrived at by Dr. Goepfert will be considered presently; but we must be content to wait for those of M. Herklots until after he has finished the laborious investigation in which he has been engaged for so many years.

In M. Junghuhn's volume on the Geology of Java, the stratigraphical characters of the rocks, in each locality treated of, are given in great detail; and copious lists of fossils, with references to the specimens, are attached to the descriptions of the principal localities. Unfortunately, however, implicit confidence cannot be placed in the determinations. M. Junghuhn did not, apparently, endeavour to trace any order of succession between the strata of the different portions of the Island, nor has he recorded the beds from which the fossils were obtained, but merely the localities. It is to be hoped that the publication of this paper will induce M. de Groot, to whom the Society is indebted for the collection about to be described, to endeavour to trace an order of superposition, and also to record the stratum from which each fossil is obtained.

At least two collections of Javan fossils exist in Germany, namely, one at Vienna, which was sent there by Dr. Hochstetter, and forms one of the numerous results of the scientific voyage of the Austrian frigate 'Novara,' and the other at Berlin, having been forwarded by Herr von Richthofen.

In 1854 Dr. Hochstetter wrote from Batavia to Director Hai-

\* Java, seine Gestalt, Pflanzendecke, und innere Bauart. Von Franz Junghuhn.

† Fossiles de Java : Description des restes fossiles d'animaux des terrains tertiaires de l'île de Java, recueillis sur les lieux par M. Fr. Junghuhn. Par J. A. Herklots. 4<sup>me</sup> Partie, Echinodermes. Leyde, 1854.

‡ Die Tertiärflora auf der Insel Java, nach den Entdeckungen des Herrn Fr. Junghuhn. Von H. R. Goepfert. 'S Gravenhage, 1854.

dinger \* stating that he had despatched two cases of fossils to Vienna, and recommending them to the notice of Dr. Hörnes; but, until after the completion of that palæontologist's great work on the fossils of the Vienna Basin, we can scarcely hope to see a description by him of these Eastern specimens. Later in the same year Dr. Hochstetter communicated to the Geological Institute of Vienna a paper on the explorations of the Mining Engineers of the Dutch East Indies †, in which he makes some interesting remarks on the geology of Java and the other Islands of the Eastern Archipelago.

The fourteenth volume of the 'Zeitschrift der Deutschen geologischen Gesellschaft' contains four contributions from Herr von Richthofen, two of which ‡ refer to the Tertiary rocks of Java and other Eastern Islands, and the others § to the geology of neighbouring districts. Herr von Richthofen comes to nearly the same conclusion, from personal observation, as that arrived at by me from a consideration of the fossils about to be described; but these conclusions and the remarks of Dr. Hochstetter will be referred to at the end of this paper.

In London there are at least three collections of specimens from Java:—one in the British Museum, collected by Madame Pfeiffer, and consisting principally of fossil Shells; one of rocks and fossils collected by Jonathan Rigg, Esq., and presented to this Society more than twenty years ago; and, lastly, the collection of fossils recently sent over by M. Corn. de Groot, also in the Museum of the Geological Society, and which has given rise to this communication.

The fossils contained in Madame Pfeiffer's collection are so entirely different from those sent by M. de Groot, that it is, perhaps, better, in order to prevent confusion, to reserve the consideration of them for another paper. Mr. Rigg's collection was evidently intended to illustrate a short paper by him "On the Geology of Jasinga," published at Batavia in 1838, and it consequently refers to an entirely different part of the Island, besides being a very heterogeneous assemblage of boulders, volcanic rocks, and fossils of more than one age; it also contains little or nothing in common with the fossils under consideration. Still, a more careful examination of this collection than has yet been made will probably result in our obtaining some further information respecting the Tertiary Formation of Java.

A very interesting paper by M. J. Hardie, referring more particularly to the Jasinga district, is contained in the fourth volume of the 'Bulletin de la Société Géologique de France' (pp. 218 *et seq.*); it was accompanied by an illustrative collection, which was presented to that Society, and would, doubtless, materially assist in elucidating the geological structure of that part of the Island.

\* Jahrbuch der k.-k. geol. Reichsanstalt, 9 Jahrgang, 1858, Verhandl. p. 102.

† "Nachrichten über die Wirksamkeit der Ingenieure für das Bergwesen in Nederlandsch-Indien," *ibid.* 9 Jahrgang, p. 277.

‡ "Bericht über einen Ausflug in Java," *op. cit.* p. 327; and "Ueber das Vorkommen von Nummulitenformation auf Japan und den Philippinen," *ibid.* p. 357.

§ Letter to Herrn G. Rose, *ibid.* p. 247; and "Bemerkungen über Siam und die hinterindische Halbinsel," *ibid.* p. 361.

Two geological maps of Java have been published,—one by M. Junghuhn, which I have not seen; and a much older one, printed on the same sheet as Sir Stamford Raffles's map of the Island, by Dr. Horsfield, of which it need only be observed that the locality whence M. de Groot's fossils were obtained, like the greater portion of the Island, is coloured as purely volcanic.

From Mr. Jukes's book on the 'Voyage of H.M.S. Fly,' it appears that he visited only the more eastern portion of Java, and that he was not able to make any very extended geological observations.

In the first volume of the 'Palæontographica'\*<sup>†</sup>, Herr Dunker gave a diagnosis and a figure of a single species of *Turritella* from Java; and, with this solitary exception, no fossil Mollusca from the Island have yet been described.

2. *Geology of the Mount-Séla District.*—The last volume of the Society's Journal contains a short paper by M. Corn. de Groot<sup>‡</sup>, in which it is stated<sup>‡</sup> that he had sent to England, amongst other rocks and fossils, a collection of specimens from the clay and marly sandstone of Mount Séla (Gunung Séla), a hill about 2000 Paris feet (2130 English feet) in height. Through the kindness of Sir R. I. Murchison, to whom these fossils were sent, they were presented to the Society soon after the reading of M. de Groot's paper.

Mount Séla is situated in the Kuningan District of the Tjeribon Residence, and forms part of the Këndenggebirge; it is also situated at the southern side of the foot of the Gunung Tjerimai—a huge volcano about 10,000 English feet in height,—and assists in forming the northern boundary of a great valley of denudation, the southern margin of which is formed by the Rantja Plateau.

Respecting this and the neighbouring districts M. Junghuhn remarks§ that "the south-western part of the Plateau of Bandung (2100 feet || high), namely, the district of Ronga, upon the south side of the Tji-Tarumkluft, is bounded on the south by a kind of 'Subapennine Formation,' which reposes upon the flanks of a still more southern, partly volcanic, arch. The strata of this formation, extending from Lio-tjitjangkang westwards to the Gunung Séla, consists of clay and bluish-white, often marly, sandstones, and are very rich in marine Shells in an extremely good state of preservation." The sandstones appear to be the principal rocks, and are further described by this author as being bluish-grey, fine- or medium-grained, calcareous (effervescing with acids), firm but easily weathering, and in places very rich in fossil Shells and Corals; and as occurring in beds, from 1 to 2 feet thick, alternating with partings, from 3 inches to 1 foot in thickness, of similarly coloured, hard, often shining, bituminous clay.

The physical features of the district may be described in a very few words, as they so nearly resemble those of the Wealden of England, and it requires merely a glance at the accompanying section (after Junghuhn) to make any geologist acquainted with the differences in

\* Vol. i. Lief. 3. p. 132. pl. xviii. fig. 10.

† Vol. xix. p. 515, 1863.

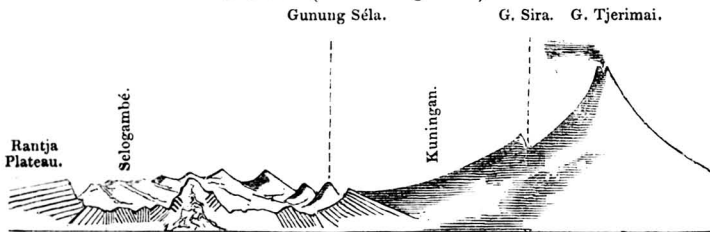
‡ P. 516 (footnote).

§ *Op. cit.* vol. iii. p. 72.

|| Paris feet, equal to nearly 2240 English feet.

the two valleys, these being differences in stratigraphical detail, caused by the volcanic axis of the Javan anticlinal, rather than differences in principle. The "form of the ground" in the two cases is also very similar; in both there are two parallel ridges, the outer and flatter sides of which form a kind of sloping plateau, while the steeper are turned towards a central valley having a minor ridge near the centre; but in Java the last-named ridge is much more evident than in the Valley of the Weald, as it is composed of an igneous and consequently less yielding rock. In the Wealden, however, the strata simply form an anticlinal more or less rolling in the centre, and much broken up by faults; but, in Java, the volcanic axis of the anticlinal has thrown the strata in its immediate neighbourhood into all sorts of positions.

Fig. 1.—Section from the Foot of the Gunung Tjerimai to the Rantja Plateau (after Junghuhn).



Even allowing for repetition by faults, the thickness of the strata in this district must be very great for a Tertiary formation, Mount Séla being more than 2000 feet above the base-line of the section. M. Junghuhn considers all the beds in this district as belonging to the same formation, and after endeavouring to explain away, in some degree, the apparent thickness, he finally computes it to be at least 10,000 Paris feet\*; but this estimate is probably much too great.

Herr von Richthofen speaks of the beds in this district as regularly superposed upon one another, and having a slight dip. He estimates the total thickness of the formation at 2000 German feet †, and describes it as a series of fine-grained marly sandstones and sandy marls, passing into and alternating with more or less trachytic conglomerates and micaceous marls, the predominating rock being, however, the fine-grained sandstone; he also observes that the whole formation is very rich in fossils.

3. *Remarks on the new Species.*—Before describing the fossils it may be as well to follow the example of MM. d'Archiac and Haime ‡, by stating the course adopted in this paper respecting new species, especially as the distance of Java from any well-known deposit similar to that from which these fossils were derived rendered the task somewhat difficult.

Of the twenty-two species of Shells contained in the collection, seven are in the state of casts; of the latter I have attempted to identify but one, that being a *Cardium* represented by many specimens,

\* 1 Paris foot is equal to 1.0654 English foot.

† 1 German foot is equal to 1.0284 English foot.

‡ Fossiles du Groupe Nummulitique de l'Inde, p. 231.

which exhibit all, or nearly all, the characters used as specific distinctions almost as well as the shells themselves would have done. The remaining six are compared with species which appear to resemble them, but have not been given other than generic names. This course is in direct opposition to that pursued by the above-mentioned authors, who, avowedly, did not attempt, in many cases, to make their "forms" of the same value as natural-history species\*, but nevertheless used them, for the purpose of supporting their conclusions, as if they had that value.

As, however, in treating of Tertiary fossils, a comparison with recent species is inevitable, it is, perhaps, better to confine specific determinations, so far as the foundation of new species is concerned, to well-characterized specimens, especially as it is very probable that the species of the palæontologist, particularly when the opposite course is adopted, are not always of the same value as those of the conchologist, who has, in many cases, all the extra advantages of knowledge of the animal, colour, and other characters, of which the palæontologist cannot take cognizance. But it should not be forgotten that the percentage of recent species in a formation may be considerably altered in consequence of these differences in the methods of, and facilities for, specific determination.

The following Table contains a list of the species, whether determined or undetermined, and a description of their matrices; the latter being taken from an examination of the substances contained in or composing the specimens.

Descriptive Number.	Genera and Species.	Material contained in, or composing, the Specimens.
1.	<i>Murex Grooti</i> , spec. nov. ....	Light-grey marl.
2.	— ? <i>paradoxicus</i> , spec. nov. ....	Greyish sand.
3.	— ? sp. ....	Dark-grey mud.
4.	<i>Pyruia cochlidium</i> , <i>Linn.</i> .....	Same as No. 1.
5.	— <i>Javanis</i> , spec. nov. ....	Greenish sandy marl.
6.	<i>Purpura umbilicata</i> , spec. nov.....	Same as Nos. 1 and 2.
7.	<i>Oliva utriculus</i> (juv. ?), <i>Gm.</i> .....	Greyish sand and greyish marl.
8.	<i>Conus striatellus</i> , spec. nov.....	Greyish marly sand.
9.	<i>Natica Duncani</i> , spec. nov. ....	Greenish-grey marl.
10.	— <i>rostalina</i> , spec. nov. ....	Reddish calcareous sand.
11.	— <i>Flemingiana</i> ?, <i>Récluz</i> .....	Reddish marl.
12.	<i>Vicarya</i> (?) <i>callosa</i> , spec. nov. ....	Sandy marl.
13.	<i>Turritella acuticingulata</i> , spec. nov.	Greenish and grey sand.
14.	— <i>simplex</i> , spec. nov. ....	Grey argillaceous marl.
15.	<i>Phasianella</i> ? sp., or <i>Paludina</i> ? sp.	Reddish sandy marl.
16.	<i>Turbo obliquus</i> , spec. nov. ....	White limestone.
17.	<i>Bulla</i> , sp. ....	Greenish-grey marly sandstone.
18.	<i>Cardium subalternatum</i> , spec. nov.	Reddish marly sandstone and greenish sandstone.
19.	<i>Pythina Semperi</i> , spec. nov.....	Same as No. 5.
20.	<i>Cytherea</i> , sp. ....	Reddish marl.
21.	<i>Tellina</i> , sp.....	Reddish sandy clay.
22.	<i>Cultellus</i> ? sp. ....	Similar to No. 21, but more sandy.
23.	<i>Amphistegina vulgaris</i> .....	Same as No. 10.
24.	<i>Astræa Herklotsi</i> , spec. nov.....	?

\* *Op. et loc. cit.*

species of the genus by its extremely large umbilicus, single row of spines, closely set and biserially arranged impressed striæ, and absence of keels and rows of granules.

In some parts of the shell, in certain specimens, the interspaces have more the appearance of raised lines, and consequently the impressed striæ appear to be the interspaces; but usually the description given above is most applicable.

*Dimensions*.—Figured specimen: length  $1\frac{1}{4}$  inch, breadth  $\frac{5}{8}$  inch; length of aperture  $\frac{2}{3}$  inch, breadth  $\frac{1}{4}$  inch.

*Matrix*.—Some of the specimens have the same matrix as *Murex Grooti*, the others the same as *Murex? paradoxicus*.

#### 7. OLIVA UTRICULUS (juv.?), Gm. Pl. VII. fig. 4.

Shell fusiformly ovate, broad, thick, with two well-defined, broad, spiral, coloured bands at the base, and with an acuminate spire. Columella very callous, the callosity extending upwards so as to cover the greater portion of the spire, and becoming much less thick towards the base, being indistinct where the columellar plaits commence—that portion of the columella appearing to be somewhat worn; columellar plaits 7 or 8 in number, separated by grooves, the lowest of which is by far the deepest and the most distinct, the others and the plaits becoming gradually fainter upwards. Aperture not very wide, gaping below; inner lip well defined, the edge of the callosity being very distinct, and, where it dies away towards the base, the area of the columellar plaits being marked off from the rest of the shell by its margin forming a more or less elevated ridge.

There are several specimens of this species in the collection, but they are all of small size, and none of them are so broad as, or have the extremely callous appearance of, adult specimens; so that it is most likely they all belonged to young individuals. There can be scarcely a doubt as to their identity with this species.

*Dimensions*.—Figured specimen (rather a small one): length  $1\frac{1}{12}$  inch, breadth  $\frac{1}{2}$  inch; length of aperture  $\frac{3}{4}$  inch, breadth  $\frac{3}{4}$  inch.

*Matrix*.—A greyish or reddish sand in some specimens, and a greyish marl in others.

#### 8. CONUS STRIATELLUS, spec. nov. Pl. VII. figs. 3a, 3b.

Shell conical, somewhat elongated at the base, and flatly convex above, with a very short mucronate spire. Whorls of a brown colour (varying in depth in different specimens and in different parts of the same specimen), scarcely overlapping, flat and slightly grooved next the suture, then conoidly convex, becoming somewhat drawn-out towards the base, and ornamented laterally with a number of blackish slightly raised stripes. Suture impressed. Aperture narrow, slightly dilated at the base. Columella slightly twisted and grooved at the base.

On the upper third of the sides of the whorls the coloured stripes are not more than half as far apart as on the middle third; and on the lower third they are accompanied, first alternately and then entirely, by slightly sinuous shallow grooves, like sutures, just above

them. Between the coloured stripes in the central part of the shell there are indications of a row of coloured dots, or of another stripe; and this ornament is rendered more complex by the presence of subordinate raised bands (probably the remains of thin light-coloured stripes), to the number of two or three, between each coloured band, and of very fine, impressed hair-lines not quite coinciding in direction with the coloured stripes. All these bands are crossed more or less at right angles by the lines of growth.

This species is closely related to *Conus fuscocingulatus*, Bronn, differing from it, somewhat, in the characters of the coloured rings, and essentially in those of the suture and the upper portion of the shell.

Of the specimens of *Conus* sent by M. de Groot, there are two (one a very imperfect specimen, three times as large as any of the others, and one about the same size as the remainder) which may belong to a distinct but related species. This cannot be decided properly without more perfect specimens; and as it is better to omit a species than to make one unnecessarily, I prefer leaving the matter in abeyance for the present, although the absence of the mucronate spire, and the much narrower aperture, in the two specimens referred to, render it very probable that they are really distinct.

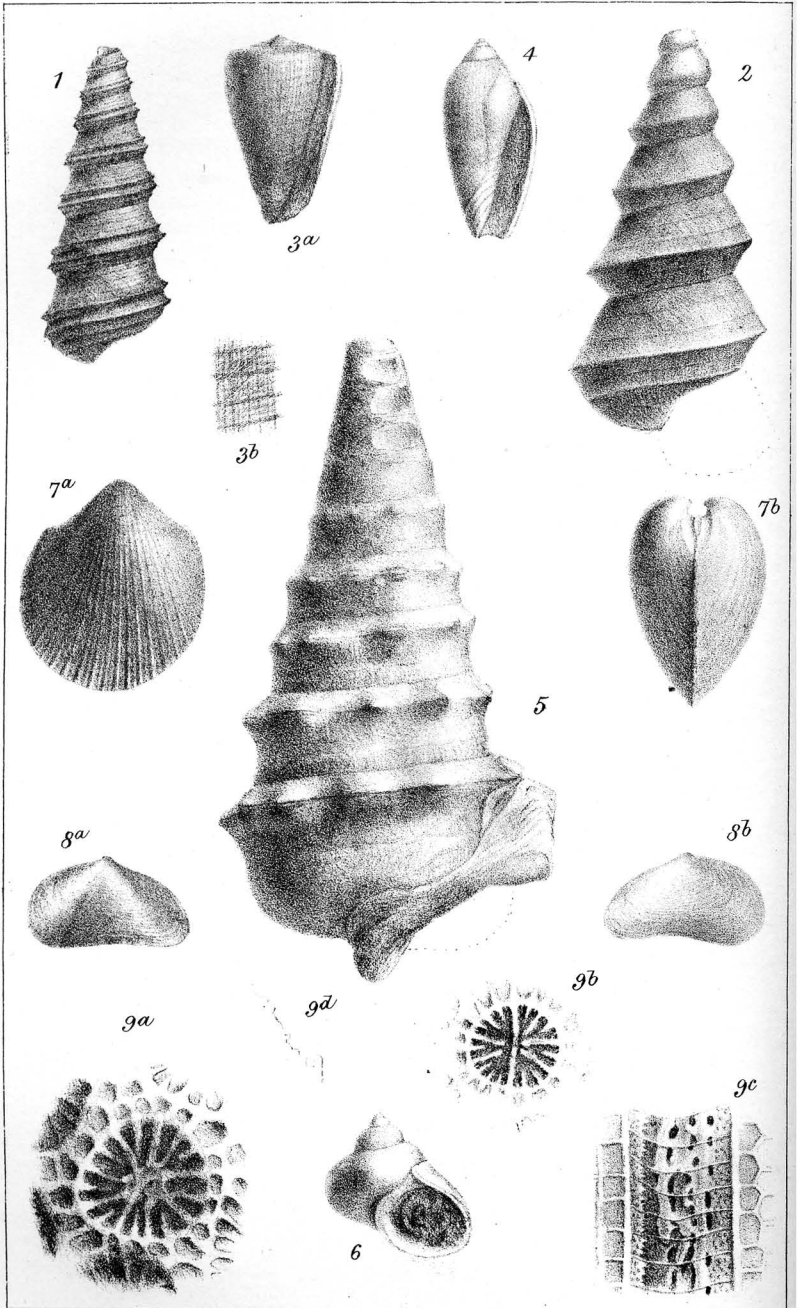
*Dimensions.*—Length 1 inch, breadth  $\frac{2}{3}$  inch; length of aperture  $\frac{21}{24}$  inch, breadth  $\frac{1}{12}$  inch. The dimensions of the two specimens which I suppose to belong to a distinct species are as follows:—large specimen, length  $2\frac{1}{3}$  inches, breadth  $1\frac{2}{3}$  inch; small specimen: length  $1\frac{1}{2}$  inch, breadth  $\frac{13}{24}$  inch; length of aperture  $\frac{10}{12}$  inch, breadth  $\frac{1}{24}$  inch.

*Matrix.*—Greyish marly sand in the specimens referred to this species. The large specimen alluded to above is filled with a greenish-grey sandstone containing large flakes of a black substance resembling charred wood.

#### 9. NATICA DUNCANI, spec. nov. Pl. VI. fig. 6.

Shell thick, ovate, rather narrowly umbilicate, with a produced spire. Whorls almost flat and obtusely grooved next the suture, then abruptly and somewhat convexly declining. Aperture ovate, almost flat at the base. Columella angular, thick, especially near the apex of the aperture, flat in front, and with a rather broad columnar callosity entering the umbilicus. Lines of growth very distinct. Operculum broadly half-heart-shaped, thick, especially near the columellar margin, broad at the base; convex margin reflexed outwardly, with a narrow groove on the outer side close to the edge, and a deeper parallel groove at a distance of  $\frac{1}{20}$  inch inside it.

The two specimens which I refer to this species differ from *Natica maculosa*, Lam., to which they bear some resemblance, in having the whorls flatter near the suture, in being more truncate at the base of the mouth, and in the columella and the whole shell being much thicker. The thickness of the upper portion of the columella and the truncated base of the mouth give the aperture an almost triangular shape, and the whole shell a somewhat remarkable appearance.



Geol. West lith. ad nat.

W. West imp.

FOSSILS FROM JAVA.