difying the extreme views of the advocates for and against elevation-craters. Although much indebted to M. Leopold von Buch for suggesting the theory, to M. Élie de Beaumont for extending and illustrating it, and to Sir C. Lyell for his efforts to explain all these appearances by reference to causes now visible, still I must express my belief, that the truth which geologists are in quest of lies in neither extreme. I think, indeed, that the day is not distant when it will be admitted, that in some tracts, in which *submarine* volcanic dejections have been very widely diffused and carried to great distances from the orifices of eruption, the strata have since been heaved up eccentrically by the subsequent operation of heat and intumescence, whether accompanied by an actual eruption of molten matter and scorix or not. Such then must be considered craters of elevation. On the other hand, in reference to true volcanic *coulées* and detritus, some districts will be shown to abound still in those grand volcanos, which during countless ages have been augmenting their area by materials, which, derived from their own bowels, have been continually added to their flanks.

POSTSCRIPT.

On writing to Dr. Daubeny for an explanation of his views, I find that on one essential point his opinion coincides with my own, viz. that the external dejections around Rocca Monfina *have been all formed under water*, perhaps of no great depth,—an opinion which I am glad I have elicited, as the most careful perusal of his memoir, in which he makes no allusion to subaqueous volcanic operations, had led me to draw another inference.

In the present state of geology, I hold it to be of the utmost importance to distinguish in a marked manner between subaqueous and subaërial volcanic action, and to note well, when it is possible, the cases where both operations have been united. It was to bring this point out in relief that the foregoing lines were penned.

FEBRUARY 27, 1850.

The following communications were read :—

1. *An Account of the STRATA AND ORGANIC REMAINS exposed in the Cuttings of the Branch Railway, from the Great Western Line near Chippenham, through TROWBRIDGE, to WESTBURY in Wiltshire.* By REGINALD NEVILLE MANTELL, Esq., C.E.

[Communicated by G. A. Mantell, Esq., LL.D., F.R.S., G.S.]

THIS railway passes over the usual series of the oolitic deposits of that part of England, and in the distance of fifteen miles the cuttings brought to light immense quantities of fossil shells, remains of numerous species of Cephalopoda, trunks and branches of trees, and a few bones of reptiles.

Mr. Morris with his accustomed liberality and kindness has carefully examined the fossils collected by me in these cuttings, and also the rich collection of Mr. Macneil, of Trowbridge, and has drawn up the lists that accompany this paper, and which constitute its most important feature.

The subdivisions of the Oolite traversed by our operations were the following :

Portland Limestone,	}	in a cutting near Westbury Station.
Kimmeridge Clay, (Coral rag wanting.)		
Oxford Clay,	}	in a cutting in the neighbourhood of Trowbridge.
Kelloway Rock, Cornbrash,		
Forest Marble,	}	occurring on a branch line, three miles long, to Bradford.
Bradford Clay,		
Great Oolite,		

The Lower Greensand is exposed at Westbury Station.

The Wilts and Weymouth branch of the Great Western leaves the main line at Thingley, a village half way between Chippenham and Corsham, and takes a southerly course to Westbury, a distance of fifteen miles, where the line terminates at present.

At Thingley the rock exposed in the cuttings of the Great Western is the Cornbrash, which extends over a large area of the neighbouring country, including Chippenham. This rock appears in the Wilts and Weymouth cuttings for a mile and a quarter, and then, on the opposite side of a steep valley, rises rapidly and crops out; the remainder of the section, which is about 11 chains long and 20 feet deep, exposing the lower beds of the Cornbrash, and the marls and shales of the Forest marble. After crossing another high embankment, the Cornbrash reappears at the entrance of the cutting, dipping rapidly, and it is not again visible till we reach Trowbridge, nine miles and a half from the junction with the Great Western.

After losing the Cornbrash at the second mile, the line continues nearly the whole way to Staverton, at the seventh mile, on embankments, keeping along the valley of the river Avon. This valley is covered with a bed of gravel from 4 to 18 feet in thickness, and from half a mile to a mile and a half in width, and in it are found boulders and pebbles of numerous varieties of primary and secondary rocks, and rolled fossils of the Oxford clay and Kelloway rock. Mounds of the Oxford clay occasionally protrude through this accumulation of water-worn materials.

At Staverton the line crosses the river Avon, and leaving the valley, enters a series of cuttings in the Oxford clay and Kelloway rock, which extend to the $9\frac{1}{2}$ mile, near Trowbridge. It was from these cuttings, averaging 14 feet in depth, that I obtained the greatest number of *Ammonites Koenigi*, *Ancyloceras Calloviense*, &c.

At seven miles and a half the railway crosses the river Biss, where the Section fig. 1 commences.

The Cornbrash reappears on the other side of the Biss, and the

Fig. 1.—Section exposed by the Trowbridge Railway-cutting.

Fig. 2.—Section at Westbury Ham, Wiltshire.

Trowbridge station-yard is excavated out of this rock. A slight fault runs across the line at the point where the booking-office now stands, and the same displacement is visible half a mile off on the side of the turnpike road to Bradford. The Cornbrash continues very level to about the middle of the next cutting, where a displacement of considerable extent brings down the Oxford clay, which continues only for 6 chains, where another fault replaces the Cornbrash, which dips south rapidly, so as to disappear almost immediately. The Oxford clay lies on the Cornbrash, and a few chains further on we find a stratum of sandstone and sand representing the Kelloway rock. This too extends but a short distance, and the next cutting at Studley (10 miles, 20 chains) brings to light the bituminous unctuous shales of the Oxford clay*. This excavation is about 13 chains long, and 23 feet at its greatest depth; from it I obtained beautiful specimens of *Belemnites* and *Belemnoteuthis*.

The whole thickness of the shales exposed by this cutting is about forty-five feet, and were we to restore them to their original horizontal position, we should have the following sequence, commencing with the beds that would be the uppermost of the series.

Two feet of drift, which covers the surface everywhere, in some places to the depth of six or eight feet,—and is sometimes difficult to distinguish from the decomposed Oxford clay, being of the same yellow colour. Contains a few elephant's teeth.

Three feet of crumbly shaly marl, containing *Serpula vertebralis*.

Five feet of shaly marl, with *Belemnoteuthides* in abundance.

Nine feet of very strong slaty clay, containing about midway a layer of pyritical *Septaria* and numerous *Belemnites*, *Belemnoteuthides*, and *Ammonites*.

Two feet of thinner slaty clay, with quantities of *Rostellariæ* and drift wood.

One foot of rock, in which the *Ammonites Reginaldi* chiefly occurred.

Five feet of thick slaty clay, containing *Belemnites*, *Ammonites*, and lignite: *Belemnoteuthis* rare.

Three feet of crumbly stone.

Two feet of very strong clay, with but a few fossils.

Five feet of thick slaty clay, containing *Belemnites*, *Belemnoteuthides*, *Ammonites Jason*, and lignite.

Ten feet more of clay was exposed, but being intersected where it cropped out, it was decomposed and crumbly from the effects of the atmosphere.

Lignite occurs in most of the beds, and frequently with *ostreae* attached. In one place a flattened tree twelve feet long was used *in situ* for some time as part of a barrow-run; so little was its vegetable structure and its strength and tenacity impaired, though the tree must have been coeval with the extinct belemnites with which it was buried. Much of the wood, especially the curious bed of lignite

* This clay emits a brilliant gas when burnt, and I have frequently used it to illuminate my room.

under the Cornbrash, was sufficiently carbonized to be used as fuel by the workmen and poor of the neighbouring cottages. The coniferous structure was easily detected by the microscope. I did not find any cones or other seed-vessels, and but few vestiges of foliage, nor did I meet with traces of *Cycadeæ*, although these plants have been occasionally found at Swindon.

Emerging from this section at $10\frac{1}{2}$ miles, and traversing a slight excavation at Yarnbrook ($11\frac{1}{2}$ miles) in the same shale, and some heavy cuttings in Kimmeridge clay, at 14 miles, we come to a very interesting section through the Ham Fields at the Westbury Terminus (see Section, fig. 2). Here a fault brings the greensand in contact with the Kimmeridge clay, and after four more displacements the greensand resumes its position, and forms the plain on which the Terminus is erected.

One of the depressions caused by a fault in this cutting is filled up by a deposit of bones belonging to elephants, horses, deer, and other quadrupeds: these remains were so plentiful that the workmen repaired the waggon roads with them. A well at the Station pierces the several beds, and enables us to continue the section half a mile further.

Organic Remains.

The abundance of fossils in some of the beds was truly astonishing, and especially the immense numbers of the shells and osselets of *Cephalopoda*. Often on exposing an area of clay or shale many yards in extent, the whole surface was studded with the glittering pearly shells of *Ammonites* of various species, and the numerous phragmacones of *Belemnoteuthis*, intermingled with *Belemnites*. With these relics of deep-sea molluscs were associated in equal abundance shells of the genera *Rostellaria*, *Turritella*, *Auricula*, &c., and throughout the mass, stems, branches, and fragments of pines and firs were imbedded. Groups of *Ammonites* scarcely larger than a pin's head, were often lying together as if they were clusters of the embryo shells, and *Belemnites* as minute as a small wire were not uncommon.

I had the good fortune to obtain a few *Belemnites* that showed the capsule of the guard, and the form of the peristome of the phragmacone; and likewise osselets of the *Belemnoteuthis* with the apical part of the phragmacone surrounded by its fibrous investment. These specimens have been figured and described by my father in the Philosophical Transactions. It may be interesting to remark, that although ink-bags in conjunction with the phragmacones of the *Belemnoteuthis* were very frequent, I never on any occasion found an ink-bag naturally attached to the phragmacone of a belemnite*.

In the subjoined lists of organic remains by Mr. Morris, the species and genera found in the respective strata are enumerated, and a

* I lately saw, in Dr. Warren's Collection, at Boston, U.S., a specimen, which might lead to an error with regard to this subject. It consisted of a belemnite with indistinct traces of the prolongation of the phragmacone, and on the top of it was loosely tied the ink-bag of a belemnoteuthis; the specimen being ticketed, "Belemnite with ink-bag, Oxford Clay, England."

few new species are named and described. The following abstract shows their distribution :—

Kelloway Rock	Radiaria,	3 genera.
	Conchifera,	16 genera, comprising 22 species.
	Mollusca,	5 genera.
Oxford Clay	Annelida,	1 genus.
	Conchifera,	5 genera.
	Mollusca,	several genera.
	—— Cephalopoda,	6 genera.
	Pisces,	2 or 3 genera.
	Reptilia,	4 genera.
Cornbrash	Radiaria,	3 genera.
	Conchifera,	8 genera.
	Mollusca,	1 genus.
Bradford Clay	Radiaria,	3 genera.
	Conchifera,	4 genera.

Thus it appears that from the small area of the bed of the Oolitic ocean exposed by the railway excavations, there were obtained above thirty genera of Conchifera, and seventeen of Mollusca, of which no less than eighteen species belong to Cephalopoda.

I will only observe, that the spectacle daily presented to my view, during the many months I was engaged on the construction of this railway, strongly impressed on my mind the conviction that I was exploring a mud-bank of an ancient ocean, to which terrestrial plants and trees, and the shells of littoral and shallow water species of mollusca, had been transported by currents, and promiscuously intermingled with the exuvæ of the inhabitants of the profound depths of the sea.

The characters of a fluvio-marine formation given by M. Constant Prevost seem particularly applicable to these deposits :—"Prédominance des sédiments alternativement argileux et arénacés régulièrement stratifiés ; abondance de végétaux terrestres et par suite d'amas et de bancs de charbons ; présence d'animaux fluviatiles ou terrestres associés dans les mêmes conches à des animaux marins. On peut ajouter que, dans les formations fluvio-marines pélagiennes, les argiles prédominent sur les grès, que les fossiles sont bien conservés, qu'ils sont isolés ou groupés avec ordre par familles et par lits, que les fossiles marins rappellent des animaux de haute mer ; enfin l'absence presque absolue des Polypiers pierreux*."

List of Organic Remains obtained by REGINALD N. MANTELL, Esq.
from the Railway Cuttings above described. By JOHN MORRIS,
F.G.S.

Kelloway Rock.

RADIARIA.
Acrosalenia — ?
Cidaridites — ?
Pentacrinus — ?

CONCHIFERA.

Pholadomya Murchisoni, Sow.
—— acuticosta, Sow.
Panopæa (Pullastra peregrina, Phil.
sp.).
Modiola bipartita, Sow.

* "De la Chronologie des Terrains et du Synchronisme des Formations," p. 5.

Isocardia tener, *Sow.*

— *minima*, *Sow.*

Arca subtrigona, *Morris*, n. s.

Amphidesina ?? *recurvum*, *Phil.*

Nucula Phillipsii, *Morris*, n. s.

Trigonia clavellata, *Sow.*

Cardium cognatum, *Phil.*

Astarte carinata, *Phil.*

Pecten fibrosus, *Sow.*

— *demissus*, *Phil.*

— *vagans*, *Sow.*

Gryphæa obliquata, *Phil.*

Terebratula socialis, *Phil.*

— *concinna* ?, *Sow.*

— *ornithocephala*, *Sow.*

Corbula Macneillii, *Morris*, n. s.

Orbicula — ?

MOLLUSCA.

Auricula Sedgwicki, *Phil.*

Turritella muricata, *Sow.*

Rostellaria bispinosa, *Phil.*

Ancylloceras Calloviense, *Morris*.

Ammonites modiolaris, *Lhwyd*, sp.

Oxford Clay.

ANNELIDA.

Serpula vertebralis, *Sow.*

CONCHIFERA.

Avicula expansa, *Phil.*

Modiola bipartita, *Sow.*

Trigonia clavellata, *Sow.*

Nucula Phillipsii, *Morris*, n. s.

Ostrea deltoidea, *Sow.*

MOLLUSCA.

Turritella muricata, *Sow.*

Rostellaria.

Belemnites abbreviatus, *Mill.*

— *Puzosianus*, *D'Orb.*

Belemniteuthis antiquus, *Pearce*.

(*Acanthoteuthis* ?)

Loligo.

Sepia ? (Two species of).

Ammonites modiolaris, *Lhwyd*, sp.

— *Chaumussetii*, *D'Orb.*

— *Koenigi*, *Sow.*

— *Jason*, *Rein.*

— *cordatus*, *Sow.*

— *Gowerianus*, *Sow.*

— *Lonsdalei*, *Pratt.*

— *Reginaldi*, *Morris*, n. s.

Nautilus truncatus ? *Sow.*

PISCES.

Teeth of *Lepidotus*.

— *Sphærodus*.

— *Pycnodus*.

REPTILIA.

Ichthyosaurus.

Plesiosaurus.

Phiosaurus.

Cetiosaurus.

Teleosaurus ?

Cornbrash.

RADIARIA.

Nucleolites clunicularis, *Agass.*

— *orbicularis*, *Phil.*

Discoidea depressa, *Lamx.* sp.

CONCHIFERA.

Pholadomya Murchisoni, *Sow.*

Panopæa (Mya) gibbosa, *Sow.*

— ? (*Pullastra peregrina*, *Phil.* sp.)

Amphidesma ? *decurtatum*, *Phil.*

Cardium cognatum, *Phil.*

Isocardia concentrica, *Sow.*

Avicula echinata, *Sow.*

Ostrea Marshii, *Sow.*

Tereb. intermedia, *Sow.*

— *obovata*, *Sow.*

— *concinna*, *Sow.*

MOLLUSCA.

Ammonites discus, *Sow.*

Bradford Clay.

CONCHIFERA.

Avicula costata, *Sow.*

Pecten vagans, *Sow.*

Ostrea costata, *Sow.*

Tereb. coarctata, *Sow.*

— *digona*, *Sow.*

— *maxillata*, *Sow.*

— *obsoleta*, *Sow.*

RADIARIA.

Berenicea diluviana, *Lamx.*

Terebellaria ramosissima, *Lamx.*

Apiocrinus Parkinsoni, *Bronn.*

(*A. rotundus*, *Miller.*)

AMMONITES REGINALDI, MORRIS.

PL. XXX. fig. 6.

Am. testâ discoideâ, inflatâ, anfractibus latis subdepressis, intus obliquè angulatis, 15-17 tuberculis prominentibus, externè costatis, costis obtusis, rotundatis, dorso convexo, aperturâ transversâ, semi-ellipticâ.

A discoidal and somewhat gibbose shell, with rather depressed and broad volutions, inner side obliquely angular, margined with about fifteen prominent rounded tubercles, from each of which arise two or three obtuse costæ passing over the broad convex back; these costæ become obsolete in an adult state.

Aperture transverse, semi-elliptical. Thickness $4\frac{1}{2}$ inches, diameter 15 to 18 inches. This shell, in possessing the same general characters, may be considered by some as an extreme variety of *Am. coronatus*, Bruguière; it varies considerably in the size of the umbilicus and number of dorsal ribs; the latter become obsolete by age in this species, as shown in the adult specimen figured (reduced) by D'Orb. Terr. Jurass. t. 169. f. 5. It also bears considerable resemblance to *Am. Banksii*, Sow. M. C. tab. 200, and which is also cited by D'Orbigny as a variety of *Am. coronatus*. This shell, from the Oxford clay near Trowbridge, presents, however, a permanent and distinct variety in which the tubercles are more round and prominent and the volutions less angular than in the normal type of *Am. coronatus*.

The large knobbed species from the Lewes chalk named *A. peramplus* by Dr. Mantell (Fossils of the South Downs, p. 200. n. 60; Sow. Min. Conch. pl. ccclvii.), also bears a general resemblance to this species.

The specific name is to commemorate the industry and research of its discoverer.

Locality. In the Oxford clay near Trowbridge.

ASTARTE CARINATA, Phillips, Geol. Yorksh. t. 5. f. 3.

PL. XXX. fig. 2.

Ast. testâ crassâ, gibbosâ, ovato-triangulari, subæquilaterali, costis obtusis concentricis instructâ, interstitiis paulo latioribus; lunulâ ovatâ, profundâ; margine intus valdè crenatâ.

Shell ovately trigonal, ventricose, subequilateral, concentrically costated, costæ obtusely rounded; anterior margin rounded, posterior depressed and slightly truncated; lunule smooth, ovate, deeply impressed, inner margin strongly dentated.

Width rather more than length; length and thickness equal.

This species is considered to be identical with the *Ast. carinata*, Phillips, Geol. Yorksh. pl. 5. f. 3, although that figure does not well display the general character; it closely resembles the *A. vetula*, Philippi (Dunker, Palæontographica, t. 8. f. 3), from the tertiary beds of Cassel, but that species has the anterior margin more angular, and the lunule distinctly striated.

The intervening furrows are double the width of the costæ, and when carefully examined exhibit faint traces of concentric striæ.

Locality. Abundant in the Kelloway rock near Chippenham and Trowbridge, and the Oxford clay of Weymouth and Yorkshire.

Numerous casts of another species of *Astarte* (PL. XXX. fig. 3) are found in the Kelloway rock near Trowbridge, resembling the one figured by Phillips, Geol. Yorksh. pl. 5. fig. 30.

CORBULA ? MACNEILLII, Morris.

PL. XXX. fig. 4.

Cor. testâ parvâ, ventricosâ, arcæformi, lævigatâ ; subæquilaterali, anticè rotundatâ, brevi, posticè carinatâ, truncatâ.

Shell small, smooth (or faintly striated), ventricose, arcæform or somewhat quadrangular, nearly equilateral, anteriorly rounded, posterior side carinated, the carina extending from the umbo to the lateral margins, which are truncated and slightly produced.

This shell strongly resembles the *Corbula dubia*, Sow., and especially the *Corb. cucullæformis*, Dunker (Beiträge, p. 31. t. 2. f. 6), with which it so generally agrees that I should have considered it the same, were it not that the incurvation of the beak (represented in the figure) is somewhat different, and also that the shell is described as striated.

Compare also *Corbula borealis*, D'Orb. (Sir R. I. Murchison's Russia, t. 41. f. 5-7).

The hinge not having been seen, this shell is placed in *Corbula* with some doubt, as it more nearly resembles some forms of *Isocardia* and *Cypriocardia*.

Dedicated to Mr. Macneill of Trowbridge, who has materially increased our knowledge of the fossils of that vicinity.

Locality. Abundant in the Kelloway rock near Chippenham and Trowbridge.

NUCULA (LEDA) PHILLIPSII, Morris.

PL. XXX. fig. 1.

Nuc. testâ transversâ, subovato-trigonâ, lævigatâ, inæquilaterali, subventricosâ, margine cardinali angulatâ.

Shell ovately trigonal, smooth, inequilateral, slightly ventricose, posterior margin rather produced, but not recurved.

The abrupt manner in which the lateral margins meet the rounded anterior margin appears to be a character of this species ; it might be compared with the *N. nuda*, Phillips, Geol. Yorksh. pl. 5. f. 5, but that shell is more transverse and inequilateral.

Locality. In the Oxford clay near Trowbridge.

ARCA SUBTETRAGONA, Morris.

PL. XXX. fig. 5.

Arca testâ ovato-quadratâ, ventricosâ, inæquilaterali, sublævigatâ, latere anteriori brevi, posteriori carinato ; areâ ligamenti rhomboidali.

Shell ovately quadrangular, ventricose, nearly smooth, or marked with shallow concentric striæ ; the sides with small radiating costæ, more prominent on the anterior part than the posterior ; posterior side strongly carinated ; ligamental area shallow, lozenge-shaped, striated ; umbones prominent, distant, involute. This shell somewhat resembles

Cucullæa inflata, Römer, but the umbones are not so prominent, and the posterior angle is more acute.

Locality. Kelloway rock, near Trowbridge.

EXPLANATION OF PLATE XXX.

Fig. 1. *Nucula Phillipsii*.

Fig. 2. *Astarte carinata*.

Fig. 3. *Astarte*?

Fig. 4. *Corbula Macneillii*.

Fig. 5. *Arca subteträgona*.

Fig. 6. *Ammonites Reginaldi*.

2. *Notice of the Remains of the DINORNIS and other Birds, and of FOSSILS AND ROCK-SPECIMENS, recently collected by Mr. WALTER MANTELL in the MIDDLE ISLAND of NEW ZEALAND; with Additional Notes on the NORTHERN ISLAND.* By GIDEON ALGERNON MANTELL, Esq., LL.D., F.R.S., G.S. &c. *With Note on FOSSILIFEROUS DEPOSITS in the MIDDLE ISLAND of NEW ZEALAND.* By Prof. E. FORBES, F.R.S. &c.

THE remoteness of New Zealand, and the long period required for the transmission of specimens to England, together with the very limited information we at present possess of the geology and palæontology of that interesting antipodean colony, impart a certain degree of importance to any accession of knowledge, however slight, relating to the physical structure, and the ancient fauna and flora of those distant islands.

These considerations induce me to submit to the Society the following remarks on a large collection of the bones of several species of *Dinornis* and other birds, of rock-specimens, and of fossil shells, corals, and infusoria, received a short time since from my eldest son, Mr. Walter Mantell, of Wellington; and although the information afforded by this collection respecting the geological structure of the country is but scanty, I would fain hope that this brief communication will not be deemed an uninteresting supplement to the memoir on the Fossil Birds of New Zealand, which I had the honour to lay before the Geological Society in 1848.

The specimens were accompanied by numerous sketches of the country, and a copy of the official report on the colonial capabilities of the eastern coast of the Middle Island, from Kaiapoi to Akaroa in Banks' Peninsula, and thence to the Scotch settlement at Otago, a distance of about 260 miles, made during my son's exploration of that tract in 1848, as Government Commissioner for the final settlement of native claims.

Such parts of this report as throw light on the geology of the Middle Island of New Zealand, together with remarks on any particular locality, are embodied in the following extracts. As an apology for the brevity of his notes, my son dwells on the arduous character of a pedestrian journey through a country but very thinly inhabited; the engrossing nature of his official duties, and the limited time

Fig. 1. *a. Nucula Phillipsii*.—Fig. 2. *a-c. Astarte carinata*. Fig. 3. *Astarte ?*
 Fig. 4. *a-c. Corbula Macneilli*.—5. *a-b. Arca subtetragona*.—6. *Ammonites Reginaldi*.
 The figures marked X are magnified.