

grey felspar-like mineral in it; in texture it then much resembles a basaltic or trappean rock. It is extremely hard and tough, and is cracked, fissured, and jointed in all directions. Occasionally one set of joints presents pretty regular and parallel lines of fracture. Many small strings of copper-ores (sulphurets, carbonates, and oxy-chlorides) are seen cutting through them, with various bearings, from N.E. to E. and W., dipping at very high angles.

Conclusion.—In conclusion, I must direct attention to the three comparative sections of the country from Arica on the Pacific to the Yungas on the eastern side of the High Andes of Bolivia (Plate III.). Although this plate is, of course, to be regarded only as a diagram, it represents correctly a summary of the conclusions at which M. D'Orbigny*, M. Pissis†, and myself have arrived in traversing the same line of country.

On examination, it will be observed that great and unaccountable differences are here depicted; and it must be left to the reader to judge, from the perusal of the different memoirs of the three authors, how far each of them may be sound in his views.

This plate does not require any further explanation than the remarks which have been occasionally made under the heads of the different formations; but it is particularly important as showing at a glance these several discrepancies, and in its bearings on the general tenor of the results here brought forward. Subsequently it will be required for reference in the second and third parts of the memoir of which this communication is the first part, and which will treat of the Geology of Chile and the Argentine Provinces; it will then be found most essential in explaining and reconciling the various statements which have been made in reference to the geology of these countries.

2. *On the FOSSILS, from the HIGH ANDES, collected by DAVID FORBES, Esq., F.R.S., F.G.S.* By J. W. SALTER, Esq., F.G.S.

[PLATES IV. & V.]

I HAVE examined this unique series with some care; and with a collection of above 200 specimens there should be no unusual difficulty in assigning the true geological date. The specimens are generally perfect enough to show the generic characters, though in very few cases is their preservation complete; and it is thought better at present (especially as Mr. Forbes intends returning over this difficult ground) to figure all the chief forms, and give specific characters only to the more prominent fossils. All the specimens from the slate-rocks are distinct from those previously published.

* Voyage dans l'Amérique Méridionale, tome iii., Partie Géologie. Par M. Alcide d'Orbigny. Paris, 1842.

† "Recherches sur les Systèmes de Soulèvement de l'Amérique du Sud." Par M. Pissis. Annales des Mines, 5^{me} sér. tome ix. 1856.

Of the Carboniferous forms little need be said. They are the same as those described long ago in D'Orbigny's large work; and similar specimens were brought home by Mr. J. Cumming during his explorations for recent shells in Bolivia. The resemblance to British fossils of this epoch is most striking, and some of the species are identical.

The Devonian gives us very scanty traces, yet scarcely doubtful. Occurring, as it does, between the Carboniferous basin and the slate-rocks, it falls naturally into the place indicated by the few fossils known to us. Mr. Pentland brought home from Aygatchi, in Bolivia, a Trilobite from this formation.

The age of the slate-rocks, however, was for a long time doubtful; and the aspect of Mr. Forbes's collection is so unlike that of any British or American type, that, while their discoverer was strongly urging their Silurian age, my own prejudice gave them a Lower Devonian character. The large *Homalonoti* (the only conspicuous Trilobites) are, on the whole, more like Devonian forms than Silurian; and the shells are of just such types as might be referred to either of these systems. The *Tentaculites* would bear the same interpretation; but a small *Beyrichia*, very rare, occurs just at the top of the whole series, and this particular form of the genus is not known in Europe to trespass beyond the Uppermost Silurian limit, or the basement-beds of the Devonian at furthest. Again, the *Bilobites* (whatever these obscure fossils may be) are all of Silurian age, and they are numerous in Mr. Forbes's collection. They have generally been regarded as Lower Silurian forms, and are, indeed, far more plentiful below the Caradoc rocks than elsewhere. But too much stress must not be laid on this; for one characteristic species occurs in the Llandovery or Clinton group of New York; moreover, all the specimens from the Andes, whether the large ones described by D'Orbigny, or the smaller ones now brought home, are of species distinct from those known in other districts. I do not believe them to be plants, but have no definite idea of their true structure, further than that they were tough hollow crusts, not soft solid masses as sea-weeds generally are.

One other remark before proceeding to notice the separate species. Wherever we meet with new areas of Silurian rocks, we find we have in them new Natural-history provinces of these old seas: it is so in India, according to Colonel Strachey's researches; and it is so in Australia: no species from either region is, I believe, identical with those of Europe. The same cannot be said of the Devonian fossils, which ranged very widely during the later part of that epoch; and the Carboniferous types are almost cosmopolitan, many of the same fossils ranging from the North Pole to Australia, and from North America and the Andes to Nepaul. It is, I think, chiefly due to this circumstance that we have been accustomed to regard the Palæozoic types as having an almost universal diffusion. This is nearly true as regards the genera, but, except in the remarkable case of the Mountain-limestone fossils, without much evidence in the case of species.

CARBONIFEROUS.

From the small basin of these rocks at the Isthmus of Copacabana, in the Lake of Titicaca, the following species were obtained:—

Productus semireticulatus, Martin. (*P. Inca*, D'Orb.) Pl. IV. fig. 1.

— *Longispina*, Sow. (*P. Capacii*, D'Orb.) Pl. IV. fig. 2.

Spirifer Condor, D'Orb. (*Sp. striatus*, Sow.?)

— *Boliviensis*, D'Orb.

Orthis resupinata, Sow.?

— *Andii*, D'Orb. (from a Santa Cruz specimen). Pl. IV. fig. 3.

Athyris subtilita, Hall. (*Ter. Peruviana*, D'Orb.) Pl. IV. fig. 4.

Rhynchonella (a species with three raised ribs, very like some varieties of *R. Pleurodon*; also from a good Santa Cruz specimen). Pl. IV. fig. 5.

Euomphalus, with separated whorls (possibly a *Phanerotinus*).

Bellerophon, sp.; a close ally of *B. Urvii*, Flem. Pl. IV. fig. 6.

Corals, also, and Crinoids, all imperfect. D'Orbigny describes a *Favosites* and a Cup-coral, a *Fenestella*, &c.; and Col. Lloyd's collection from Arque, as well as Mr. Cumming's from Santa Cruz, both include such specimens. I see no essential difference between the *Productus semireticulatus*, so common in Britain, and the so-called *P. Inca* of D'Orbigny; and I think it would puzzle any one to draw a clear distinction between his *P. Capacii* and our own familiar *P. Longispina*, found everywhere in the Carboniferous Limestone. The *Spirifer Condor* has certainly rougher ribs than the ordinary varieties of *Spirifer striatus*, and may be distinct. We figure (Pl. IV. fig. 3) one remarkable form, said to be from Santa Cruz, but, at all events, from the Carboniferous Limestone of the Andes, of which less perfect specimens occur in Mr. Forbes's collection. It is a beautiful species of the *Orthis resupinata* group, and has received the absurd name of *O. Andii* from D'Orbigny.

Our figure of the *Rhynchonella* (Pl. IV. fig. 5) is also from this collection, which was sent home by Col. Lloyd many years back.

DEVONIAN*.

ORTHIS, sp. Pl. IV. fig. 7.

Internal casts only. It belongs to the group of *Orthis resupinata* and *O. Michelinii*, and thus may be either Carboniferous or Devonian.

Locality. Oruro. Sent from thence by Col. Lloyd. (Mus. Practical Geology.)

* Of the seven species considered Devonian by D'Orbigny, only four appear to be certainly supra-Silurian; and these four may (from their type) be either Devonian or Carboniferous. They are—*Rhynchonella Peruviana*, *Spirifer Boliviensis*, *S. Quichua*, and *Orthis Inca*. *Spirifer Quichua* is from Chuquisaca, the other three from Cochabamba.

The *Orthis pectinata*, on which D'Orbigny lays stress, seems to me to be very unsatisfactory. It is only the cast of a single valve, without hinge or teeth, of a shell destitute of any marked characteristics. I should not like to speculate as to its age; but M. D'Orbigny may have seen Devonian species like it.

PHACOPS LATIFRONS, Bronn. (*P. Bufo*, Green.) Pl. IV. fig. 8.

In all essential particulars this agrees with the common Devonian species known in Europe under the name *P. latifrons*, and in America by Dr. Green's appellation *P. Bufo*. Comparing it with either Spanish or American specimens, I see no difference, except a somewhat flatter axis, and perhaps one rib fewer in the tail-piece. The group of *Phacops* to which it belongs sometimes occurs in Upper Silurian strata; but this species is nevertheless a most characteristic Devonian form, and has an immense geographical range.

Locality. Near Oruro. In a rolled pebble.

Mr. Pentland found near the town of Aygatchi, Bolivia, another *Phacops*, which, from its type, belongs most certainly to Devonian rocks. It is one of the group *Cryphæus*, distinguished by having the border of the tail spinose; moreover, it is not far removed in affinity from the characteristic *Phacops Caffer* and *P. Africanus* of the Cape of Good Hope. *P. (Calymene) Verneuilii* of D'Orbigny appears to belong to the same section, and is probably of the same age.

PHACOPS (CRYPHÆUS) PENTLANDII, n. sp. Pl. IV. fig. 9.

Rather more than 2 inches long, and $1\frac{1}{4}$ inch broad, convex, long-ovate, with a subtriangular head; the tail pointed, ribbed throughout, and with a tubercular or subspinose border.

Head $\frac{3}{4}$ inch long, blunt-trigonal; the glabella broad, inflated in front, the forehead-lobe rhomboidal and blunt-pointed, but not overhanging; the facial suture supra-marginal. The margin itself is thin in front, thickened only round the sunken cheeks, and is cut near its (spinose?) posterior angle by the facial suture. Eye prominent, of many moderate-sized lenses, set far forward, but not close to the glabella.

Body-rings (much broken) with the axis very prominent, and with four spines on each ring, besides one *within* the fulcrum on the pleura, and one (or two?) *outside* it; pleural groove deep, broad; ends of pleuræ truncate.

Tail-piece triangular, 6 lines in length, wider than long, with a very convex axis reaching the tip, and marked by six or seven strong rings, the rest indistinct. The sides are about the same width as the axis, with six strong curved ribs (the upper ones duplicate), not furrowing the narrow border, but faintly continued on it into marginal tubercles. Both the lateral ribs and the axis have tubercles on them. The terminal spine, if one existed, is broken off.

There are several Bohemian species of *Phacops* which resemble this in the tubercular ornaments of the body; but none that I know have a tuberculato-spinose border to the tail; and this character, combined with the inflated forehead-lobe, will certainly restrict the fossil to either Upper Silurian or Devonian: it cannot be Carboniferous.

Locality. Aygatchi (*Mr. Pentland*, 1827). It comes, according to that gentleman, from beds of the Carboniferous series; it would ap-

pear from Mr. Forbes's statements, that it could only be from the sandstones at their very base; and I must claim these as Upper Devonian.

Favosites (?), sp. Pl. IV. fig. 10.

I find no pores in any of the tubes (but only some tubercles), and very few traces of tabulæ. Possibly it is not of this genus.

Locality. Given to Mr. Forbes (by Mr. Bogen, of Tacna) as having been found near Oruro.

UPPER SILURIAN.

All the thick beds of sandstone, intercalated with many layers of sandy shale, appear to lie in the upper part, or middle part at least, of Mr. Forbes's Silurian section; and in these the chief part of his fossils were found. The lower beds (chiefly shale and thin sandstones) contain the *Bilobites* (or *Cruziana*) and very little else; and, seeing that his sections gave a measured thickness of at least 15,000 feet (all of which, as he judges by the mineral aspect, belongs to one and the same series), there is much reason for supposing the lower part to be of Lower Silurian date. This is borne out by the presence of the *Bilobites*, which, as above noted, is chiefly a Lower Silurian type.

D'Orbigny has figured a Graptolite, with one row of cells, from South America; and this alone would prove the presence of Silurian rocks, upper or lower. It is from Tacopaya, Santa Cruz.

HOMALONOTUS LINARES, n. sp. Pl. V. figs. 1 & 2.

Body (?) faintly trilobed (fig. 1 *a*); pygidium (fig. 1 *b*) $1\frac{1}{4}$ inch long, and about as broad, triangular, regularly convex, with the sides not abruptly bent down. The axis is but faintly marked, quite as broad as the sides, and scored by about sixteen rings; the sides show nearly as many furrows, none of which reach the margin. The apex is pointed, the tail gradually tapering to it, not abruptly acuminate. The sides (apparently from fig. 1 *b*) are bent inwards beneath; and the apex also shows some indications of a broadish triangular space. The whole surface appears smooth.

The species is not unlike *H. delphinocephalus*, Murch., but has many more ribs, and a longer axis.

Locality. From the highest point reached by its discoverer: he found it on the all but inaccessible face of Mount Illampu, at the height of 20,000 feet. Named in honour of his Excellency the President of Bolivia.

HOMALONOTUS, sp. Pl. V. fig. 3.

Not perfect enough to describe. It has a blunt rounded shape, like that of *H. obtusus*, Sandberger, and several other German and French species from Devonian rocks. The axis is more strongly ribbed than the sides, and the surface is roughly granular.

Locality. From the same mountain as above, at a somewhat lower level (about 15,000 feet).

PROETUS, sp. (a fragment). Such fragments are common both in Upper Silurian and Devonian rocks.

Locality. Same mountain (16,000 feet).

[BEYRICHIA FORBESII, Jones, n. sp. Pl. IV. fig. 13 *a, b, c*, nat. size and magnified.

Carapace-valves oblong-ovate; straight on the dorsal and obliquely curved on the ventral edge; obtusely tapering at one end, obliquely truncate at the other; bordered below and at the ends with a slight rim: surface raised into four, equidistant, unequal, transverse, rounded ridges; the one next to the narrow end of the valve lowest and shortest, the next one highest and longest of all.

This is nearly allied to *Beyrichia Bussacensis* from the Lower Silurian rocks of Portugal (Quart. Journ. Geol. Soc. vol. ix. pp. 141, 160, pl. 7. figs. 5 & 6); but it is narrower, and its ridges are differently proportioned. It also approaches in form to the figure of a *Beyrichia* that has been published (without description) by Prof E. Emmons among some Silurian Fossils of North America in his 'Manual of Geology,' 2nd edit. 1860, p. 100, fig. 90.

This little fossil is seen in some numbers (together with *Tentaculites*) on a small piece of dark-grey calcareous schist from the western slope of Illampu in the Bolivian Andes. It is dedicated to its adventurous discoverer, Mr. David Forbes.—T. R. J.]

TENTACULITES SUPREMUS, n. sp. Pl. IV. fig. 11.

Nearly an inch long, diameter 2 lines, cylindrical, slowly tapering until near the apex; marked at intervals of about a line by cord-like ridges, strongly projecting, and often in pairs. Between these are close concentric annuli, or fine ridges, about thirteen in the space of a line.

The strong double ridges which ornament this species occur chiefly on specimens which have the rings more distant than others. They remind one much of the *Tentaculites* in the Wenlock strata of the Isle of Gothland. I believe this species to be a new one; it is a good deal like *T. ornatus*, Sow.

Locality. On the snowy ridge of Illampu, in company with *Homalonotus Linares*. A *Ctenodonta* and a Cup-coral are found with them.

TENTACULITES SAENZII, n. sp. Pl. IV. fig. 12.

Tapering more rapidly than the last, and marked by numerous equidistant rounded rings [with no intermediate annuli?]. The want of annular striæ may be only a comparative character; but the regularity of the somewhat oblique rings seems to be specific.

Locality. It occurs in the grey shaly beds between the grits of Illampu, and is dedicated (by Mr. Forbes's request) to Señor Saenz, whose kind and efficient help was of great service to him in his explorations.

Smaller *Tentaculites* (fig. 13 *a*) occur in some of the slabs with the

Beyrichia above noticed; but they are probably the young of one of the foregoing species.

In Europe the strata in which *Tentaculites* are conspicuous are—Caradoc Sandstone, Llandovery rock, and Lower Devonian. In North America (New York) they appear to be more specially confined to the Devonian strata. They are known all over the world in Palæozoic rocks.

Burrows and Casts of Marine Worms.

Such impressions as these attract the attention of every close observer. The peculiar habits of marine worms, introducing, as they do, the sabulous matter from one stratum into the more clayey beds of another, have a special tendency to render the rock compact and tough-bedded. Mr. Forbes found the worm-markings of all sizes, both in the upper and lower beds of the Silurian rocks, and either as double burrows, single vermicular casts, or in groups, just as we find them in our own Ludlow, Devonian, and Carboniferous strata.

ORTHIS AYMARA, n. sp. Pl. IV. fig. 14.

Variety (?) of *Atrypa palmata*, Morris and Sharpe, Quart. Journ.

Geol. Soc. vol. ii. pl. 10. fig. 3: *Orthis palmata*, Sharpe, Trans.

Geol. Soc. 2 ser. vol. vii. p. 207.

Circular, or only slightly transverse, strongly ribbed, with a very short, almost obsolete hinge-line; ventral valve convex, gibbous near the beak, with a depressed central rib near the margin; upper or dorsal valve flat, with two slightly raised ribs in the middle; ribs about 14, acute, no intermediate ones. Diameter about half an inch.

The above may stand as the obvious characters of this abundant species. As distinguished from the common southern form above quoted, the size is less, and the ribs not quite so prominent; but the chief difference is in the interior, which shows (in *O. palmata*) very strong dorsal teeth, and the ventral hinge-plates thick and short. Ours has but thin plates, and moderate-sized teeth.

I hardly see sufficient reason for considering *O. Aymara* a distinct form. It is very similar to the common African species above quoted, which also occurs at the Falkland Islands. The same fossil appears also to be frequent in the Lower Devonian rocks of Gaspé, Canada. But these localities being all Devonian, one is scarcely justified in uniting with these the Silurian shell from the Andes, if there be any structural differences. *Orthis palmata* is evidently a common shell; and such species have, as Edw. Forbes first showed, a wide range in time as well as geographically: *Atrypa reticularis* is a case in point, ranging, as it does, from the Middle Silurian to the Upper Devonian, and as a frequent shell throughout. The *O. Aymara* may, very probably, when we have more specimens, turn out to be the Silurian variety of a shell which attained a fuller development in Devonian times as *O. palmata*.

Localities. Valley of Millepaya, and other localities on the western side of the Andes.

[The Aymara Indians are supposed to have been the original inhabitants of these mountains. They still linger there, having never been completely conquered, and never having amalgamated with the Quichua or Inca race.—D.F.]

ORTHIS, sp. Pl. IV. figs. 15 & 16.

A small *Orthis*, which may be equally compared with varieties of the *O. elegantula*, Dalm., or with the Devonian forms, *O. opercularis*, &c., from the Eifel. The striæ seem to be pretty regularly interlined with smaller ones. In the absence of more perfect specimens, I do not give it a name. It is certainly not a young specimen of the *O. Humboldtii* of D'Orbigny.

Locality. Valley of Millepaya, and further south on the western slope of Illampu.

STROPHOMENA, sp.

A mere fragment or two of a small thin-shelled species, with fine radiating striæ.

Locality. Cotaña, about five miles south of the town of Sorata.

CUCULLELLA, sp. Pl. IV. fig. 17.

The transverse, oval and convex form of this shell reminds us of *C. ovata*, Sow., rather than *C. antiqua* of the same author. Both are Ludlow Rock species: but there are Lower Devonian forms very like them both in Britain and South Africa. The muscular plate extends, vertically, two-thirds across the shell.

Locality. West face of Illampu.

Ctenodontia (*NUCULA*), sp. Pl. IV. fig. 18.

This is figured, because it is rather common. Such transverse forms, concentrically striate, and a little antiquated in the lines of growth, are known in all Palæozoic formations.

Locality. Valley of Millepaya; also further south, on the western slope of Illampu.

ARCA ? *BROWNII*, sp. Pl. IV. figs. 19 & 20.

Broad-oval, more than $2\frac{1}{2}$ inches wide, and $1\frac{3}{4}$ deep; the beak at the anterior fourth not very prominent, the hinge-line tolerably straight, not curved down. The posterior side is nearly as broad as the depth of the shell beneath the beak, slightly angulated along the posterior slope, and rounded at the posterior angle. The anterior side is somewhat produced, and straight along its hinge-margin. Surface marked by rather distant lines of growth, and covered all over the central parts of the disk by fine radiating striæ, sharply impressed, very unequal in size and depth, wavy in their course to the margin, and interlined by lesser ones. They are altogether absent on the anterior and posterior fourth. On our large specimen this effacement of the striæ is gradual; but in some others it is sudden, and the central striated area in these specimens is sunk below the general surface. These may be of a distinct species,

Fig. 20 represents a young specimen. The outline is much more rounded, however, if that be not due to pressure; and the duplicated striæ cover all the surface.

Locality. West slope of Illamipu. [Fieldmarshal Brown, a well-known general of the War of Independence, and after whom this shell is named, showed much interest in these researches, and was of great assistance to the author of the foregoing memoir.—D. F.]

BELLEROPHON, sp.

About 1 inch wide, having a large body-whorl, a small spire, and the whorls not at all involute; umbilicus quite open, and the whorls sloping towards it. Striæ of growth arched backwards to the carinate margin, which, however, is obtuse, not sharp-edged.

Locality. Common enough in some hand-specimens from the west side of Illampu.

PATELLA OR PILEOPSIS ?

An extraordinary specimen of a subovate clypeiform shell, an inch and a half in its largest diameter, and rather more than an inch wide, has an excentric blunt umbo, and a rather wavy margin. The surface is covered with close concentric ridges, which show equally well on the external and internal cast. The general appearance is that of an oblique *Patella*, or rather one of the *Calyptroëidæ*. But it is too imperfect to decide upon. Patelliform shells are known in the Silurian, but they are very rare.

Locality. West side of the Valley of Millepaya.

LOWER ? SILURIAN.

CRUZIANA, D'Orbigny.

It seems hardly worth while to separate these obscure fossils into several genera while we know so little of them; but certainly they cannot all belong to one group. The distinctly grooved and bilobed form, which induced M. Cordier to apply the name *Bilobites* to them, is characteristic of the species described by D'Orbigny, and of some others found in N. America. The more elongate strap-shaped species found in Europe have already received names from M. Rouault in his memoirs on the Silurian Rocks of France. And the species here figured belong to such various plans of form that, if we only knew a little of the nature of the bodies in question, we should be bound to give them separate names; at present I only propose one for the sagittate forms—*Boliviana*. Mr. Forbes did not meet with either of D'Orbigny's species, which, from that author's description, came from Lower Silurian beds*. Those here described are also the lowest fossils in the section.

* "C'est le premier corps organisé qui se montre au-dessus des phyllades schistoides, dans les phyllades micacés brunâtres."—Voyage, &c. vol. iii. part 4 (Paléontologie), p. 31. Mr. Forbes thinks, however, that there is no evidence of their being so low in the series.

CRUZIANA CUCURBITA, n. sp. Pl. V. figs. 4, 5, & 6.

Three inches long, elongate, clavate, curved into a shape more or less sigmoid, subcylindrical in section, compressed; rounded at the anterior end, tapering posteriorly; smooth, except a few irregular wrinkles, but with a raised longitudinal rib throughout (down each side?).

I am not sure whether the raised rib which runs from end to end of these shapeless masses is an external marking, or arises from an internal hard cylinder. Fig. 6 shows some irregular transverse wrinkles; but, except these, there is no marking whatever to distinguish this form, which may be recognized by its blunt clavate shape, like many of the gourd-fruits, whence the name.

Locality. Very plentiful on the surfaces of grey schist. Valleys of Unduavi and Aceromarka.

CRUZIANA UNDUAVI, n. sp. Pl. V. figs. 7 & 8.

Three or four inches long, subcylindrical, but often flexuous, slowly tapering. Surface marked with numerous (9 or 10) longitudinal ribs, which run for short distances only, and alternate, leaving some parts smooth. The general direction of the ribs is longitudinal, but wavy.

Localities. Valleys of Aceromarka and Unduavi, where it is most abundant.

BOLIVIANA, gen. nov.

Form obcordate or sagittate, tuberculate or ridged, without a central furrow, and produced behind into two barbs or wing-like appendages. (A peduncle or stem occurs in some species.)

These broad arrow-shaped forms differ so much from the true *Cruziana*, that it does not seem premature to separate them. (I leave the elongate forms at present all in one genus.) And the general term *Bilobites* may still be conveniently used for the whole group, though not now accepted as a generic term.

BOLIVIANA MELOCACTUS. Pl. V. fig. 9.

Three-quarters of an inch long, obcordate, deeply notched behind, and pointed and produced backward on each side. Surface gently convex, rising into a ridge along the median line, which projects a little in the middle of the deeply emarginate posterior edge. Six longitudinal ridges, narrower than the central one, run along the whole length, with irregular tubercles on them, arranged so as to form transverse rows, seven or eight on each side.

A rough resemblance to the mammillated plants so common in the region of the Andes suggests the name.

Locality. Valley of Aceromarka, north-eastern slope of Illimani.

BOLIVIANA PROBOSCIDEA. Pl. V. fig. 10.

This appears to be only about half of the disk, and it is therefore described as if the longitudinal ridge (*a*) were central. An inch and a half long, narrow-sagittate, lanceolate, convex; with a very

prominent central ridge, produced behind into a thick blunt spine. Posterior edge doubly emarginate, but with the angles scarcely at all produced. Six longitudinal ribs on each side of the central one, all closely tuberculate, so as to form transverse rows.

The projecting mass is supposed to be the stem, and is nearly as long as the frond, very thick, obtuse, attached to the posterior margin, and shaped like the siphon-sheath of a bivalve shell.

Locality. Valley of Aceromarka.

BOLIVIANA BIPENNIS. Pl. V. fig. 11.

Mr. Forbes observed the other part of this specimen in the rock, but could only detach one half. The outline is therefore added to our figure.

Frond semioval, emarginate behind, gibbous at the sides, and with the posterior angles produced into strong divergent tapering spines. Surface marked by ridges and furrows parallel to the curve of the front and back margins. Spines also furrowed near the base. Stem (apparently attached) long filiform.

Locality. Valley of Unduavi, eastern slope of the Andes.

Summary.

The number of species that we recognize in this collection, made with so much perseverance and at great personal hazard, are—

- 5 Lower? Silurian (Bilobite-schists).
- 14 Upper Silurian (grey sandy schists and sandstones).
- 3 Devonian.
- 13 Carboniferous.

D'Orbigny's collection of Silurian fossils contained 10 species, of which none have occurred to Mr. Forbes. They are—

Cruziana rugosa.
 — *fureifera.*
Orthis Humboldtii.
Lingula marginata.
 — *Muensterii.*
 — *dubia.*
Graptolites dentatus.

Phacops (*Calymene*) *Verneuilii*,
 — (*C.*) *macrophthalma*?
Asaphus Boliviensis.

There is some doubt about both his species of *Phacops*. They are probably Devonian.

Adding these to our list, we obtain 27 or 29 Silurian species for the Central Andes, belonging to a fauna specifically different from that of any other quarter of the world. I venture without hesitation to assert that the identifications by D'Orbigny with European forms, where I am acquainted with the species, are wrong. I am obliged to say this much, since that distinguished author has fearlessly united things which differ by the most obvious external characters, and has lent the sanction of his great reputation, on such evidence as this, to a former community of species, and an equable diffusion of heat. In regard to the Carboniferous forms, where M. D'Orbigny is unwilling to allow more than a close analogy between the two continents, I am again compelled to differ from him, but it is in an opposite direction.

EXPLANATION OF PLATES IV. & V.

Illustrating Mr. Salter's paper on some Palæozoic Fossils from the Bolivian Andes.

PLATE IV.

- Fig. 1. *Productus semireticulatus*, *Martin*. Isthmus of Copacabana.
 2. *P. Longispina*, *Sow.* Isthmus of Copacabana.
 3. *Orthis Andii*, *D'Orb.* Santa Cruz.
 4. *Athyris subtilita*, *Hall.* Isthmus of Copacabana.
 5. *Rhynchonella*, sp. Santa Cruz.
 6. *Bellerophon*; like *B. Urii*, *Fleming*. Isthmus of Copacabana.
 7. *Orthis*, sp. Oruro.
 8. *Phacops latifrons*, *Bronn.* Oruro.
 9. *Ph. Pentlandii*, *Salter.* Aygatchi.
 10. *Favosites* (?), sp. Oruro.
 11. *Tentaculites supremus*, *Salter.*
 12. *T. Saenzii*, *Salter.*
 13 a. *Tentaculites*, sp., and *Beyrichia Forbesii*, *Jones.* } Illampu.
 13 b & 13 c. *Beyrichia Forbesii*, *Jones.*
 14. *Orthis Aymara*, *Salter.* } Valley of Millepaya.
 15, 16. *Orthis*, sp.
 17. *Cucullella*, sp. Illampu.
 18. *Ctenodonta* (*Nucula*), sp. Valley of Millepaya.
 19. *Area* (?) *Brownii*, *Salter.* Fig. 20. Young specimen. Illampu.

PLATE V.

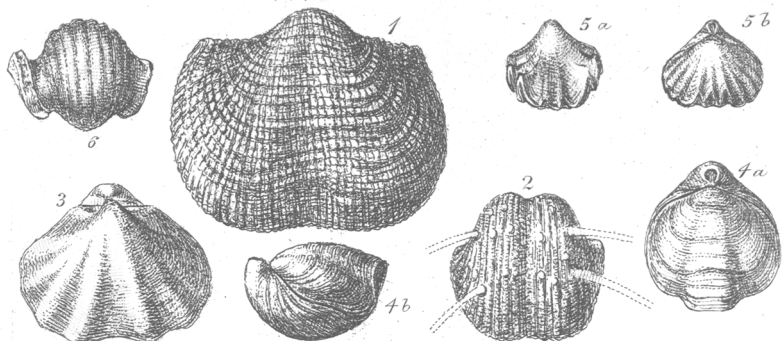
- Fig. 1 & 2. *Homalonotus Linares*, *Salter.* } Illampu.
 3. *Homalonotus*, sp.
 4, 5, & 6. *Cruziana Cucurbita*, *Salter.*
 7 & 8. *C. Unduavi*, *Salter.* } Valleys of Aceromarka and Unduavi.
 9. *Boliviana Meloëactus*, *Salter.*
 10. *B. proboscidea*, *Salter.*
 11. *B. bipennis*, *Salter.*

3. On a NEW SPECIES of MACRAUCHENIA (*M. Boliviensis*). By THOMAS H. HUXLEY, F.R.S., Sec. G.S., Professor of Natural History, Government School of Mines.

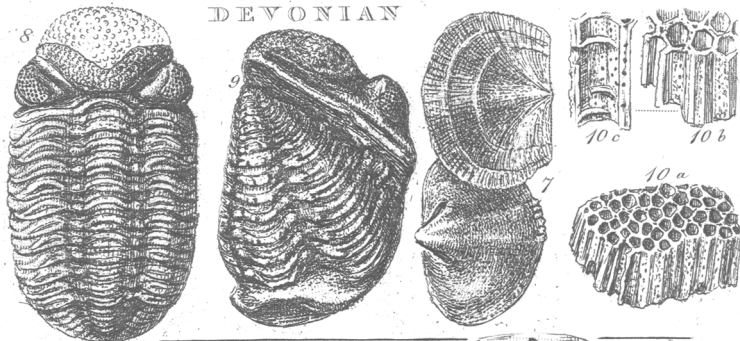
[PLATE VI.]

THE vertebrate remains obtained by David Forbes, Esq., F.R.S., F.G.S., from the mines at Corocoro, under the circumstances detailed in his paper "On the Geology of Bolivia and Southern Peru," consist of the following parts of the skeleton of apparently one and the same Mammal:—1. A portion of the right maxilla and palate, with fragments of grinding teeth. 2. Rather more than the right half of the occipital portion of the skull. 3. A middle cervical vertebra, nearly entire. 4. A fragment of a posterior lumbar vertebra. 5. A small portion of a right scapula. 6. A crushed fragment of the proximal end of an ulna. 7. Part of the proximal end of the left tibia. 8. The entire left astragalus, and part of the right astragalus.

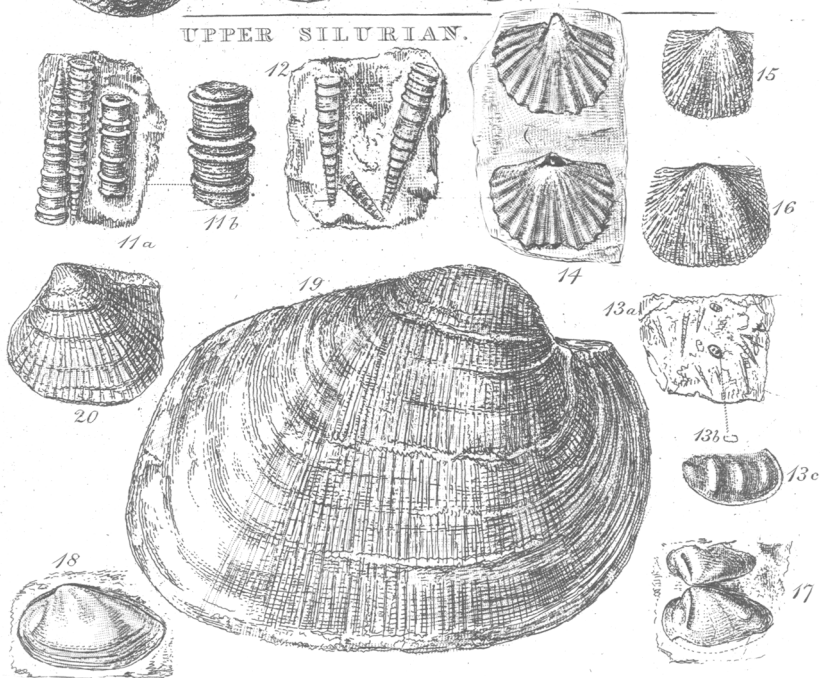
CARBONIFEROUS.



DEVONIAN



UPPER SILURIAN.

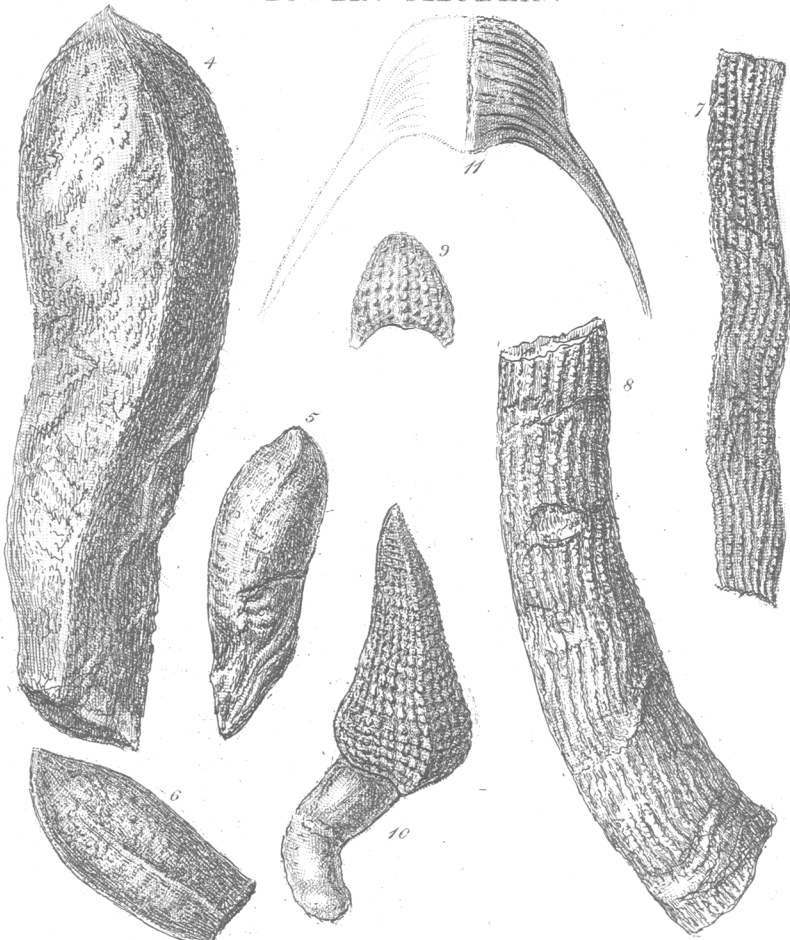


FOSSILS from the ANDES.

UPPER SILURIAN.



LOWER? SILURIAN.



FOSSILS *from the* ANDES.

G.B. Sowerby.