No. 13. — *Recent Corals from Tilibiche, Peru, by* Alexander Agassiz *and* L. F. Pourtalès.

The corals described here by Mr. Pourtalès were collected in a ravine about two miles east of Tilibiche, in the valley of Berenguela. Tilibiche is on the northern edge of the Nitrate Basin to the rear of Pisagua, Peru. These corals are interesting, coming as they do from a height of 2,900 to 3,000 feet above the level of the sea, at a distance in a straight line from the Pacific Ocean of twenty miles. The ravine where they were found is about 450 feet below the general level of the great Nitrate Basin of Peru, on the eastern side of the ridge, parallel to the coast which divides the so-called Pampa de Tamarugal from the lower narrow pampas extending from the summit of the coast terrace (at a height of about 1,100 feet) to its western base. The height of the base of the second parallel chain ranging from 2,500 to 3,000 feet. The river flowing through the valley of Berenguela has cut a deep cañon not only through the comparatively soft deposits underlying the Nitrate Basin, but also through the Jurassic beds which constitute the greater part of the chain forming the eastern edge of the Nitrate Basin. The corals were found attached to the surface of the rocks in the interstices between adjoining masses, growing much as they would at the present day in similar circumstances.

From the general features of the country along the Pacific coast of Peru it requires but little imagination to reconstruct the former internal sea formed by the Coast Range, which must have, within comparatively recent geological times, covered the whole of the Nitrate Basin, and which has gradually been elevated to its present position. At one time (the older period) this inland sea was connected with the Pacific through the breaks of the Coast Range forming the quebradas of Vitor, Camarones, Pisagua, Loa, etc., and subsequently became an inland salt lake disconnected from the Pacific, to be eventually drained by the breaking through of the barriers at the old points of connection with the Pacific. This inland salt lake was thus gradually changed to a lagoon, and finally entirely drained as soon as the rivers flowing through it, forming the above-

mentioned valleys, had cut their way as cañons through the strata underlying it. It seems therefore possible that even if the former extension of the Pacific Ocean over the tract occupied by the nitrate beds cannot account entirely for the deposition of the salt and nitrates; it must at any rate have played an important part in their formation. The rivers, taking their rise higher up in the Andes to the eastward, flowing through the basins, are all fresh. The water near the general surface of the basin is saline, but as we go down we soon reach a stratum of absolutely fresh water, showing that if the saline matter were brought down from the mountains it must have all been washed out at the present day, and that the main cause to which the formation of the nitrates has been assigned is no longer active. Certainly neither the number nor size of the extinct and actual river-beds crossing the Nitrate Basin favors the presumption that they could have been a sufficient cause for the accumulation of the immense deposits of salt extending over the large area covered by the nitrate and other saline beds.

From the careful observations made by Darwin on the elevation of the west coast of South America, the positive proof of the recent elevation of the continent (at certain points) to a height of 800 feet is placed beyond doubt, it can, judging from terraces and other somewhat less positive proofs, be considered as reasonably certain that this elevation extended to a height of 1,300 feet, while the presence of corals at Tilibiche would seem to leave but little doubt that the continent has gradually been raised within a comparatively recent period to a height of at least 2,900 feet. The presence of extensive saline basins on the west slope of the Andes, at a height of over 7,000 feet, flanked on their western edge by low ridges, may be due to a similar cause. But, however this may be, we might almost be tempted to claim that the elevation of the continent can be traced to a still greater height, judging from the presence of eight species of Allorchestes, a genus belonging to a truly marine family of Crustacea (Orchestiadæ) in Lake Titicaca, at a depth of 66 fathoms, and thus attempt to establish the former connection with the sea of the lake now at a height of 12,500 feet above the level of the Pacific. Only eight, and two of these are probably identical species, out of eighty-one known species of this family, as I am informed by Mr.

Faxon, inhabit either fresh water or live inland in moist localities. It is, however, quite remarkable that in none of the other fresh-water lakes in which marine forms have been found, Lakes Superior, Michigan, Lake Wetter, or in Lake Baikal, and other lakes supposed formerly to have had a connection with the sea, has this family as yet been discovered, though a closely allied species of Allorchestes has an extensive geographical distribution in the rivers of the Northern United States. It must also be remembered that we have four species of Orchestias which are land inhabitants, living under damp leaves at a considerable distance from the sea.

There were a few other interesting specimens found in this locality which unfortunately have been lost. One species of Millepora, very closely allied to M. alcicornis, and a species of a Crustacean, closely allied to a large Aega, which was found in a pool near Tilibiche.

In the saline pools there were numerous specimens of fresh-water Gastropods (Hydrobiniæ). Diptera and Neuroptera larvæ were found in abundance.

These corals are fossilized into a compact crystalline limestone, the crystals having generally destroyed the internal structure; they are impregnated with salt, which effloresces after washing.

Isophyllia duplicata n. sp. (Plate, figs. 1, 2, 3.)

Rounded masses about 10 cm. in diameter; the lower surface is not preserved, so that the absence or presence of an epitheca remains undetermined. Calicles coalescing in very sinuous series, containing sometimes six or seven centres which remain, however, always very distinct. The adjacent walls remain always separated by a furrow, across which the costæ are frequently continuous. The latter are thick and appear to have borne blunt spines. The septa are thick, with blunt equal teeth; four cycles, with occasional rudiments of a fifth, the septa of the first, second, and sometimes third, not very different, and reaching to the centre. No paliform lobes, but sometimes a slight thickening of the septa in their place. Columella generally absent; occasionally one or two obscure papillæ represent it. Width of calicinar valleys 5 to 6 mm., of mural furrows 2 to 3 mm.

This genus and its nearest allies (Symphyllia we do not think can be separated from it) is not represented in any lower strata than the Tertiary,

and they have their fullest development in recent seas. There are none living now, however, on the Pacific coast of America, but Symphylliæ, Mycetophylliæ, Manicinæ, and other genera of the *Lithophylliacées méandroides* of Milne-Edwards and Haime are very abundant and characteristic of the West Indian Fauna.

Convexastræa? peruviana n. sp. (Plate, figs. 4 and 5.)

Mostly in small spheroidal masses, from 1 to 8 cm. in diameter. Calicles crowded, small (2 mm. in diameter), deep. Septa thick, with apparently smooth edges, in six regular systems and three cycles, the primary septa alone reaching the centre, but leaving a small space between the ends. Septa of adjacent calicles sometimes coalescing. No distinct wall or furrow perceptible between the calicles. No pali or columella visible, although a small space in the centre looks as if it had been occupied by the latter.

This fossil, which at first sight reminds one of a Porites, on account of the size of the calicles and general aspect, comes nearest the genus Convexastræa, and particularly Convexastræa Waltoni Edw. & H. Still I am not quite satisfied with this identification. The species of that genus described thus far belong to the Jurassic and Triassic formations.

EXPLANATION OF THE PLATE.

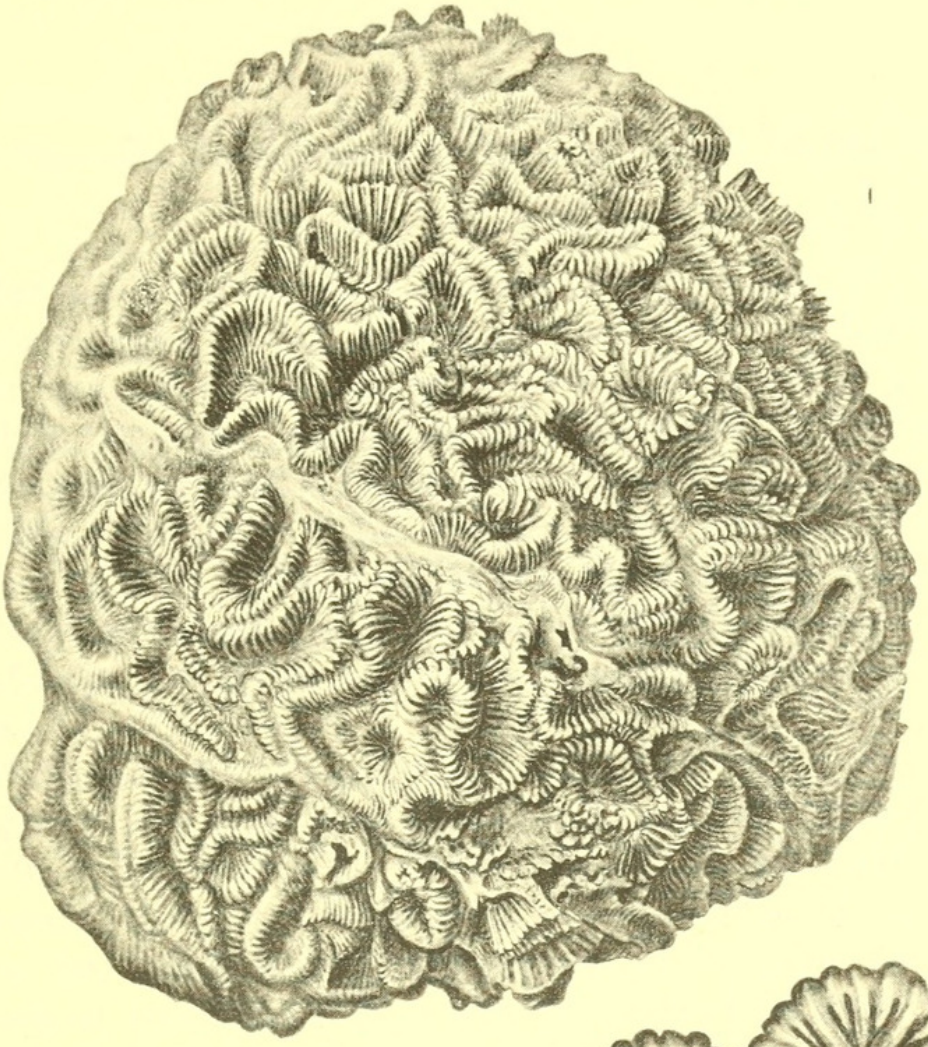
Fig. 1. Isophyllia duplicata n. sp. Nat. size.

" 2. Magnified portion of the same.

" 3. Single calicle nearly circumscribed, magnified.

" 4. Convexastræa ? peruviana n. sp. Nat. size.

" 5. Calicles of the same magnified.



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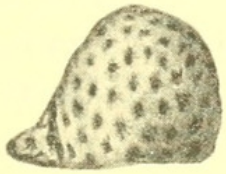

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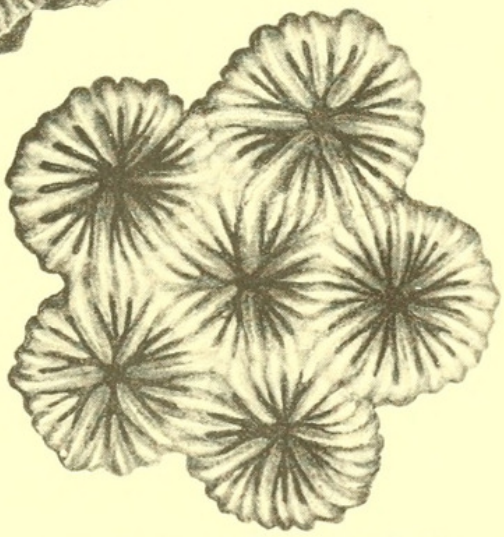

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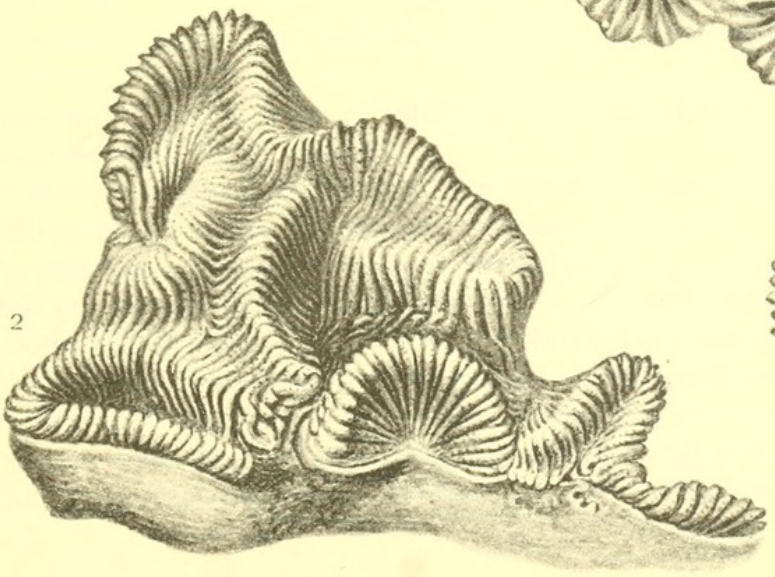

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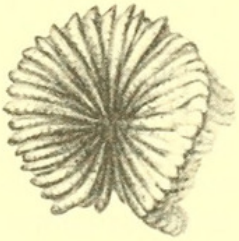

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