Observations on the genus *Promicroceras*.

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THE genus *Promicroceras* was separated from *Xipheroceras* by Dr. L. F. Spath to include *Ammonites capricornoides* and the *Am. planicosta* group. The researches of Dr. W. D. Lang on the Dorset coast have shown that the genus *Promicroceras* persists with relatively slight changes from the " birchi " zone up to the " ziphus " zone.[1]

The separation of the species of *Promicroceras* is based mainly on the stages attained in the flattening on the costae on the periphery of the whorl, together with whorl shape and the spacing of the costae. The earliest forms are those which have the costae continuous across the periphery with almost no flattening, e.g. *Promicroceras capricornoides* Quenstedt and *P. pyritosum* Spath. *P. marstonense* Spath is the common form of the Marston Stone and it differs from *P. planicosta* Sowerby in the more rapid growth and greater width of outer whorl. *P. perplanicosta* Spath shows a further flattening of the ribs on the venter than is seen in *P. planicosta.*

In the present investigation, specimens of *Promicroceras* have been examined fron Lyme Regis, from the " Marston Stone " of Marston Magna, and from Radstock. My thanks are due to Dr. W. D. Lang and Mr. S. S. Buckman for kindly lending me specimens from the Lyme Regis and Marston Magna areas, and to Dr. A. E. Trueman for much help and encouragement in the work.

Sutures.—In general, the sutures of members of this genus are never very complex. The wide external saddle [2] is rather flat topped with the first lateral saddle somewhat lower than the ES ; the first lateral lobe is usually small and shallow and the auxiliaries few. The ES is cut by two notches and is therefore normally tripartite ; but one notch is usually a little deeper than the other, and the divisions of the saddle are unequal. The IL is frequently bifid, but there is a tendency for one of the minor lobules to develop further and therefore produce a feebly trifid appearance. There are slight differences in suture pattern within the genus but the differences are not usually sufficiently prominent or constant to form a means of distinction between the various species, especially as there is some variation in suture line among members of the same species.

Sutural development.—In *Promicroceras planicosta* the first suture has the typical angustisellate pattern ; in the second suture there is a shallow external lobe which is deepened in the succeeding sutures. In the seventh suture the EL is divided by a small median saddle. The ES remains entire until a diameter of about 4 mm. is

[1] W. D. Lang and L. F. Spath, " The Black Marl of Black Ven and Stonebarrow " : Q.J.G.S., lxxxii, 1926, p. 144.

[2] The external saddle, external lobe, first lateral saddle, first lateral lobe, are referred to as ES, EL IS, and IL respectively throughout this paper.

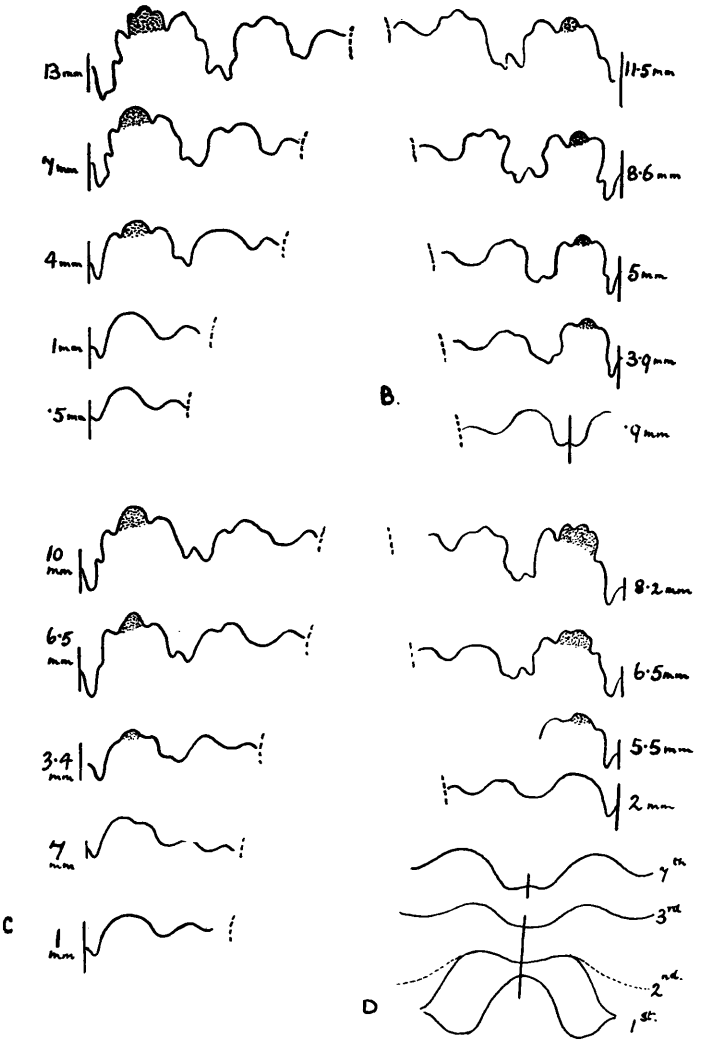

FIG. 1.—Diagrams to illustrate the sutural development of A. *Promicroceras* cf. *pyritosum*, B. *P. capricornoides*, C. *P. marstonense*, D. *P. planicosta*. The median cell of the ES is shown dotted in each case.

reached, when a feeble notch appears on the internal side, and at a diameter of 5 mm. the ES is tripartite. At a diameter of 6·2 mm. the median cell of the ES has become complicated by minor frilling. Meanwhile the three cells of the ES develop unequally and the saddle has become almost bipartite owing to the relatively rapid development of the internal cell of the ES. [The median cell is shown dotted in each of the figures illustrating the sutural development.] The IL remains entire until a diameter of 5·1 mm. is reached, when it becomes feebly bifid. An additional feeble notch on the internal side causes the IL to appear transitional between the bifid and trifid condition ; it is more than half as deep as the EL (Fig. 1 D).

In a dissected specimen of *P. marstonense* a flattening on the umbilical side of the ES is to be seen at an earlier diameter (2·7 mm.) than in *P. planicosta* and this develops into a feebly bipartite ES. At 3·6 mm. the ES is feebly tripartite and develops into an unequally tripartite ES in the adult. It is to be noticed therefore that the tripartite condition of the ES appears to be established earlier in this species than in *P. planicosta*. In some specimens the internal notch of the ES is the deeper one, while in other specimens the external notch is the deeper. The IL is shallow and bifid and about half as deep as the EL (Fig. 1 C).

In a specimen referred to *P.* cf. *pyritosum* a tripartite ES is well defined at 4 mm. and is even more strongly tripartite than in *P. marstonense* at this diameter. The external cell remains small and the internal, and in particular the median cell, become much enlarged. In *P. capricornoides* the ES also passes through a tripartite stage, feebly indicated at a diameter of 3·9 mm., but well established by 5 mm. diameter. The three cells grow to about the same size, but the internal notch is deepened and the resulting ES is unequally bipartite ; what appears to be the external cell of the bipartite ES in this case is made up of the external and median cells of the tripartite stage. The IL of *P. capricornoides* is mainly bifid but shows a tendency to become trifid in the earlier and later stages. It is more than half as deep as EL.

It is to be seen, therefore, that the early development of the suture in various species of *Promicroceras* follows what may be considered a normal course for an unspecialized ammonite.

Each species at some stage or other possesses a tripartite ES. In many cases, however, the tripartite ES develops into a bipartite ES, this being accomplished in at least two ways, namely (*a*) the median and internal cells of the ES develop more rapidly than the external cell of the ES, e.g. the specimen of *P. planicosta* described above ; (*b*) the median and external cells of the ES remain nearly equal while the internal cell of the ES becomes much enlarged and the internal notch is deepened, e.g. *P. capricornoides*.

This can be compared with what has occurred in some species of *Echioceras* in which genus a bipartite ES is considered typical. These species possess a tripartite ES at some stage in their develop-

ment; for example in a specimen of *E. modicum* [1] a tripartite ES is to be seen in the adult suture (41 mm.) but in a specimen of *E. raricostatoides* [2] the tripartite ES passes into a bipartite ES by the more rapid development of the internal and median cells of the ES. In the case of *E. aeneum* [3] however, the adult suture shows a bipartite ES which seemingly had developed from an ES which was never tripartite.

Whorl shape.—The changes in whorl shape have been studied by means of transverse sections of the shell taken through the protoconch (Fig. 2). It will be noted that the embryonic and nepionic whorls of *P. capricornoides* and *P.* cf. *pyritosum* are crescent shaped, embracing the preceding whorls to a great degree, and as a result of this the umbilicus at the centre becomes deep and narrow. The early whorls of *P. planicosta* and *P. marstonense* on the other hand are more evolute; the ratio of whorl height to the depth of the impressed area is about 5 : 1 compared with about 2 : 1 in

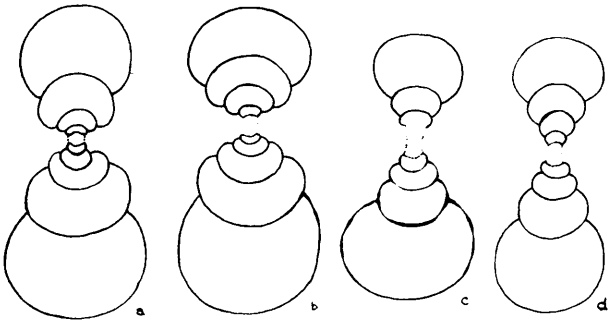

FIG. 2.—Transverse sections taken through the protoconch of (*a*) *Promicroceras capricornoides*, (*b*) *P. pyritosum*, (*c*) *P. marstonense*, (*d*) *P. planicosta*. × 9.

P. capricornoides and *P. pyritosum*. The central portion of the umbilicus in *P. planicosta* is therefore shallow and flattened. In other words the increase in umbilical diameter for the same number of whorls in the early stages of *P. capricornoides* and *P. planicosta* is less in the former than in the latter. It is evident then that there is some difficulty in estimating the actual diameter from the umbilical diameter. Taking only umbilical diameter into consideration there seems to be some variation in the diameter at which ribbing appears; sections, however, show that the actual diameters in these cases are about the same, and in any case the ribbing appears after about the same number of whorls. For example, the average

[1] "Studies in the Ammonites of the Family Echioceratidae," A. E. Trueman and D. M. Williams, *Trans. Roy. Soc. Edinb.*, vol. liii, 1925, p. 714, fig. 8.
[2] Ibid., p. 708, fig. 5.
[3] Ibid., p. 716, fig. 12.

umbilical diameter at which the first rib appears in *P. capricornoides* and *P. pyritosum* is between 4 mm. and 4·5 mm. The number of specimens of *P. planicosta* and *P. marstonense* available for measurement was considerably smaller, but the umbilical diameter at which ornamentation appeared ranged from 5·2 mm. to over 6 mm. This at first sight appears to suggest a lengthening of the early smooth stage in the development of the planicosta group, which is presumed to have evolved from a capricornoides-like ancestor. But the evidence from the transverse sections shows that the number of whorls in *P. planicosta* at the umbilical diameter of 5 mm. is about the same as the number in *P. capricornoides* at the umbilical diameter of about 4 mm., and it may be suggested that the smooth stage in each species of *Promicroceras* extends over approximately the same number of whorls.[1]