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BATHONIAN AMMONITES

BY

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Superfamily *PERISPHINCTACEÆ* Steinmann, 1890.

(as *Perisphinctinae*)

Family MORPHOCERATIDÆ Hyatt (1900, p. 583).

This family has been reviewed by Buckman (1920, TA, iii, p. 22), Thalmann (1925), Spath (1928, pp. 252—3), and Wetzel (1937, pp. 129—131). Buckman (1898, p. 459) regarded *Morphoceras* as a “decadent form of *Sphæroceras*,” and Wetzel (1937) and Schindewolf (1953) still place the family in the Stephanocerataceæ. Spath (1928, p. 254), on the other hand, favoured derivation of Morphoceratidæ from Perisphinctidæ (*sensu lato*) [i.e., from *Leptosphinctinae*], and this view is adopted here. The constrictions and general appearance of *Morphoceras* strongly suggest affinity with Perisphinctidæ, and there are several known instances of transitional forms between the two families, whereas nothing is known that could be a link between Morphoceratidæ and any Stephanoceratacean stock.

The transitions between perisphinctids and morphoceratids, on the other hand, were two-way, and those that occur in the Lower Bathonian and are described below are (on the hypothesis here adopted) reversions from Morphoceratidæ to forms like Perisphinctidæ. Siemiradzki (1898, p. 79) already suggested that *Morphoceras* gave rise to some perisphinctids. An instance is the curious Lower Bathonian *Polysphinctites polysphinctus* Buckman, which has a strongly perisphinctoid appearance, but is linked by other allied species (*M. replicatum* Buckman sp.) to more typical Morphoceratidæ. On the other hand, *Polysphinctites ebrayoides* sp. nov., which has a similar nucleus, links *Polysphinctites* to *Ebrayiceras*; and such species as *Ebrayiceras jactatum* and *E. vaschaldi* are transitional between *Ebrayiceras* and compressed species of *Morphoceras*.

Again, there is enough similarity between *Morphoceras* and *Leptosphinctes* or *Vermisphinctes* for Schloenbach (1865, pl. xxix, figs. 2—5) to have figured under one species (*Ammonites tenuiplicatus* Brauns) a *Vermisphinctes* (fig. 2), a *Morphoceras* (fig. 5) and two nuclei which might be either (figs. 3, 4, renamed by Wetzel, 1950, pp. 78—9), and for this concept of the species to have been accepted by Brauns himself (1869, p. 129). Still, nearly half a century later, *A. tenuiplicatus* was called a *Perisphinctes* by H. Douvillé (1916, p. 23) and a *Morphoceras* by de Grossouvre (1919, p. 390), two leading experts on Middle Jurassic ammonites.

In this way may well have arisen the first morphoceratids, of which the earliest known is the Upper Bajocian *Dimorphinites*, without ventral smooth band or groove. In the Old World the earliest known perisphinctids are also Upper Bajocian, but in the Americas *Leptosphinctes* is reported from the Middle Bajocian, Sauzei Zone, of both Alaska (Imlay, 1952, p. 979) and Argentina (Jaworski, 1926, pl. ii, fig. 4). The Argentine form was taken by Jaworski for a *Morphoceras* and compared to *M. defrancei* (d'Orb.), but from the figure it appears to be a strongly constricted, nearly smooth *Leptosphinctes*, like *L. davidsoni* Buckman (1921, TA, iii, Pl. CCI) of the English Subfurcatum Zone. No morphoceratid is known from strata as early as this anywhere in the world: another indication of the greater probability that Morphoceratidæ first evolved from Perisphinctidæ, not vice versa.

Buckman (1920) included in *Morphoceratidæ* some peculiar elliptically-coiled genera with strangely aberrant body-chambers and apertural apophyses: namely, the Upper Bajocian *Æcoptychoceras* Buckman (1920, TA, iii, p. 24), and the Callovian *Æcoptychius* Neumayr (1878, p. 68), to which might be added the Bathonian *Sphæroptychius* Lissajous (1923, p. 101), and the Oxfordian *Protophites* Ebray (1860, p. 63, pl. iv) (= *Christolia* Rollier, 1909, p. 614, *non* Brullé, 1846). According to modern ideas (Spath, 1928, p. 252, Wetzel, 1937, p. 137) these are homœomorphs, side shoots from unrelated stocks; as Wetzel puts it, "specially blatant cases of iterative evolution." It must be admitted, however, that this is still only guess-work, and there is no agreement on the stocks from which each genus may have sprung. Spath considered the Bajocian and Bathonian forms to be offshoots of *Stephanoceratidæ* and the Callovian *Æcoptychius* an offshoot of *Macrocephalitidæ*; Wetzel relates the Bajocian and Bathonian genera to *Sphæroceratidæ* and *Æcoptychius* to *Cadoceratidæ*; Hyatt (1900) placed *Æcoptychius* in *Reineckeidæ*. Neither the suture of *Æcoptychoceras* (figured by Wetzel) nor that of *Æcoptychius* (visible on material in the Sedgwick Museum) has the broad and pronged second lateral lobe of the *Tulitidæ*. The Bathonian *Sphæroptychius*, however, is here regarded as probably a *Tulitid* (p. 88).

Advanced closure of the aperture in *Ebrayiceras* by "jugal apophyses" has been taken by Berry (1928, p. 102) to indicate a planktonic mode of life, since swimming would seem to have been impeded.

In style of ribbing, general form, and strong ventral sulcus, *Ebrayiceras* closely resembles some of the Callovian *Reineckeidæ*, as pointed out by Ebray (1864). The discovery by Guillaume (1928a) of a typical *Ebrayiceras* in the Middle Bathonian has considerably narrowed the gap between them and has opened the possibility that still more connecting links remain to be discovered in the Upper Bathonian; but the origin of the *Reineckeidæ* (beginning in the Lower Callovian of Cutch with *Epimorphoceras decorum* Waagen sp.) is still problematic (see Spath, 1928, pp. 252—4).

1. **MORPHOCERAS** H. Douvillé (1880, 'C.R. Soc. géol. France,' p. 22; and 'Bull. Soc. géol. France' [3], viii, p. 242). Type species by original designation *Ammonites polymorphus* d'Orbigny (1846, p. 379, pl. 124), of which the specimen illustrated in d'Orbigny's fig. 4 (Text-fig. 47) was designated lectotype by Buckman (1920, TA, iii, p. 22). The type species was renamed *Morphoceras multiforme* (this monograph, p. 17) because d'Orbigny's name is a junior homonym of *A. polymorphus* Quenstedt (1845, p. 86; Lower Lias) and a synonym of *A. parkinsoni inflatus* Quenstedt (1846, p. 145, pl. xi, figs. 6, 7), but Quenstedt's name is not available because *Ammonites inflatus* was already several times preoccupied.

Characteristic features (Text-fig. 47) are the inflated, involute, "olcostephanid" inner and middle whorls, with narrow umbilicus, and more evolute "perisphinctoid" outer whorl or whorls, numerous prorsiradiate constrictions which cut across the ribbing, ventral smooth band, and relatively simple suture-line. Aperture simple. The type horizon for *M. multiforme* and its allies is the Zigzag Zone, Lower Bathonian.

Patemorphoceras S. Buckman (1922, TA, iv, Pl. CCCLI). Type species by original designation *P. patescens* Buckman, Zigzag Zone, Broad Windsor, Dorset. Synonym of *Morphoceras* Douvillé (see p. 133 and Plate XVII, fig. 5).

Asphinctites S. Buckman (1924, TA, v, Pl. CDLXXXIV). Type species by original designation *A. recinctus* Buckman, Fuller's Earth, Midford, Somerset. Holotype (Text-fig. 51) believed destroyed by bombing of Bristol Museum and no other material known. Differs from typical *Morphoceras* by its more evolute, perisphinctoid coiling at all stages, by feebleness of its constrictions, and absence of ventral smooth band. Wetzel (1937, p. 131) regards it as a synonym of *Morphoceras*, but in view of these differences it is advisable to reserve judgment until more material is discovered.

2. **DIMORPHINITES** S. Buckman (1923, TA, iv, Pl. CCCLXXVII). Type species by original designation *Ammonites dimorphus* d'Orbigny (1846, p. 410, pl. 141), Upper Bajocian, Bayeux, Normandy. Wetzel (1937, p. 131) unites this also with *Morphoceras*, but it differs by the tighter coiling and occluded umbilicus of its inner and middle whorls, by its collared and lipped aperture, and lack of ventral smooth band at all stages.



TEXT-FIG. 47.—*Morphoceras multiforme* Arkell. Left, reproduction of d'Orbigny's original figure of lectotype (1846, pl. 124, fig. 4). Right and centre, specimen from the Zigzag Bed, Burton Bradstock (SM. J28879) (Natural size.)

3. **POLYSPHINCTITES** S. Buckman (1922, TA, iv, Pl. CCCXXII, A, B, C). Type species by original designation *P. polysphinctus* Buckman, Zigzag Zone, Burton Bradstock (Plate XVI, figs. 6—8). Buckman described the type species as “a serpentine *Morphoceratid*,” but Spath (1931, p. 281) thought it “a dwarfed *Leptosphinctes*.” Its systematic position is a matter of opinion, but Buckman's view is here followed because of the likeness of its inner whorls to those of some undoubted *Morphoceras*, and because the ribbing seems more morphoceratid than perisphinctid. Inner whorls smooth to faintly ribbed, deeply and repeatedly constricted; coiling evolute-planulate throughout. Suture simple. Aperture with large spatulate lappets.

4. **EBRAYICERAS** S. Buckman (1920, TA, iii, p. 22). Type species by original designation *E. ocellatum* Buckman (1920, TA, iii, Pl. CLXXIII), from the Zigzag Zone, Broad Windsor, Dorset (Plate XVII, fig. 7). The type species is a “thinner and more umbilicate” variety of the well-known *Ebrayiceras pseudo-anceps* Ebray (from the same horizon), which according to Thalmann's monograph (1925, p. 21) is extremely variable. Roman (1938, p. 207) regarded *Ebrayiceras* as only a subgenus of *Morphoceras*, but it is much more *Reineckeia*-like and has peculiar apertural features, and is generically distinct according to the taxonomic scale aimed at in this monograph.

Ebray (1864, p. 263) thought *E. pseudo-anceps* so like *Reineckia anceps* that the only distinction he could name was the shorter primary and longer secondary ribs.

? 5. **SULCOHAMITES** Wetzel (1937, p. 135). Type species by original designation *S. eimensis* Wetzel (1937, p. 135, pl. xiv, figs. 8a–c), from the Lower Bathonian, ? Württembergicus Zone, of Eimen, near Hanover. An uncoiled ammonoid differing from Spiroceratidæ by the possession of old mouth-borders and a concave impressed area or dorsum, bounded by ridges which seem to be relics of the dorso-umbilical angle of coiled ammonites. Wetzel considered it an uncoiled offshoot from *Ebrayiceras*. Only a single fragment is known.

Genus **MORPHOCERAS** H. Douvillé (see p. 130).

1. **Morphoceras multiforme** Arkell. Plate XVI, figs. 1, 2; Text-figs. 47, 50.

Ammonites polymorphus d'Orbigny. 1846. p. 379. pl. 124, figs. 1–4 (non figs. 5, 6) (non Quenstedt, 1845, p. 86. Lower Lias. now *Polymorphites*).

Ammonites Parkinsoni inflatus Quenstedt, 1846, p. 145, pl. xi, figs. 6, 7 (non *A. parkinsoni* J. Sowerby, 1821. non *A. inflatus*. J. Sowerby, 1817) (Quenstedt refers to *A. polymorphus* d'Orbigny. and so must be later).

Ammonites Parkinsoni inflatus Quenstedt, 1858. Der Jura. p. 472, pl. lxiii. fig. 10.

Ammonites Parkinsoni inflatus Quenstedt. 1886, p. 618, pl. lxxiii. fig. 20 only.

Sphaeroceras polymorphum S. Buckman, 1881, p. 598.

Morphoceras polymorphum H. Douvillé. 1880, p. 242.

Morphoceras polymorphum S. Buckman. 1920, TA, iii, p. 22.

Morphoceras polymorphum Riche & Roman. 1921, p. 149. pl. vii. figs. 2. 2a. 4.

Morphoceras polymorphum Thalmann, 1925, p. 23, fig. 2.

Morphoceras polymorphum Roman, 1933, p. 69, pl. ii, fig. 16 only.

Non *Morphoceras polymorphum* Roman, 1935, p. 30, pl. v, fig. 1.

Morphoceras multiforme Arkell. 1951, this monograph, p. 17.

Type.—Buckman (1920, TA, iii, p. 22) designated d'Orbigny's fig. 4 "genolectotype," by which he meant the specimen on which the genus should be based. Since by the Rules the type of *Morphoceras* Douvillé was already the species *A. polymorphus* d'Orbigny (by original designation), Buckman's action was tantamount to designation of a lectotype for the species *A. polymorphus*, and is so accepted here. In Text-fig. 47 d'Orbigny's fig. 4 is reproduced (unfortunately the ventral view was not figured). With it is now shown, in lateral and ventral views, a Dorset specimen that matches it closely and comes from the same horizon. No type material could be found in the d'Orbigny Collection, and through the tragic accidental death of Louis Guillaume in 1952 it has not been possible to figure any Norman specimens promised by him for this work.

Description and Remarks.—The full description by Thalmann (1925) cannot be improved at present. As Buckman (1881, p. 598) perceived, the inner whorls of the large evolute specimen illustrated in d'Orbigny's figs. 5 and 6 are much more evolute than the small specimens with which he included it (see under *M. macrescens*).

In Thalmann's monograph the dates of publication of the relevant parts of Quenstedt's and d'Orbigny's works are both wrongly stated; but in any case both names

are preoccupied. It is undesirable to adopt for the whole species Thalmann's name *densicostatum*, introduced for a more densely-ribbed and more evolute variety, which is here regarded as a separate species. Nor is it possible to use any of the four varietal names provided by Wetzel (1937, pp. 131—2), based on drawings in Quenstedt (1886, pls. lxxiii, lxxiv). Var. *depressa* is based on a ventral view only and so cannot be compared with the lectotype figure, a side view only, but it agrees with *M. patescens* Buckman (1922); var. *perinflata* is a separate species and is not confined to Swabia as Wetzel thought, for it has been collected with other species by Mr. H. R. Warman at Monte Inici in Sicily. The other drawings are altogether different.

Distribution.—Zigzag Zone: Broad Windsor, Dorset (BM. C35912, GSM. 24714). Burton Bradstok (GSM. 24715, 25230; SM. J28879—81; Bomford Coll. 1326, 1962, 2850, 3891, 3901). Foreign: generally distributed in the Zigzag Zone in France, also in Switzerland, Swabia, Morocco, Algeria and Persia. From south of Pardeh Mah, Elburz Mts., the late E. J. White sent me 7 specimens, associated with *Ebrayiceras pseudoanceps* (2), *Oppelia fallax* (10) and many other Lower Bathonian ammonites.

2. *Morphoceras patescens* (S. Buckman). Plate XVII, fig. 5.

? *Ammonites Parkinsoni inflatus* Quenstedt, 1886, pl. lxxiii, figs. 18, 19 only (fig. 19 = var. *depressa* Wetzel, 1937, p. 132).

Patemorphoceras patescens S. Buckman, 1922, TA, iv, Pl. CCCLI.

? *Morphoceras polymorphum* Roman, 1933 (*pars*), p. 69, pl. ii, fig. 17 only.

Description of Holotype.—The diameter is 82 mm. and there is $\frac{3}{4}$ whorl of body-chamber. Septa cease at about 52 mm. At 75 mm. the dimensions are .35, .28, .37; at estimated 50 mm. they are .46, .44, .27. The inner and middle whorls are more coarsely ribbed than in *M. multiforme* and have a wider umbilicus. The outer whorl becomes more compressed, the body-chamber more contracted, the coiling more excentric than in *M. multiforme*. On the middle whorls the ribs branch twice, *Ataxioceras*-like, as in *M. Pingue* (see below, p. 135).

Roman's 'variété à large ombilic' assigned by him to *M. polymorphum* (1933, p. 69, pl. ii, fig. 17) is too small a nucleus for definite identification in default of other material, but probably represents this species.

Distribution.—Zigzag Zone: Burton Bradstock cliff (Bomford Coll. ? 3899) and Broad Windsor, Dorset (holotype, GSM. 47151, also nucleus, GSM. 25231): Brambleditch quarry, Doultling (Bristol Univ. Mus.); Swabia (Quenstedt). ? Algeria: Lower Bathonian, Zigzag Zone, Jebel es-Sekika, Oran.

3. *Morphoceras macrescens* (S. Buckman). Plate XVI, fig. 4; Plate XVII, fig. 3.

? *Ammonites polymorphus* d'Orbigny, *pars* 1846, pl. 124, figs. 5, 6 only.

Patemorphoceras macrescens S. Buckman, 1923, TA, iv, Pl. CCCLXXVI.

Morphoceras angelomontanense Thalmann, 1925, p. 27, fig. 3.

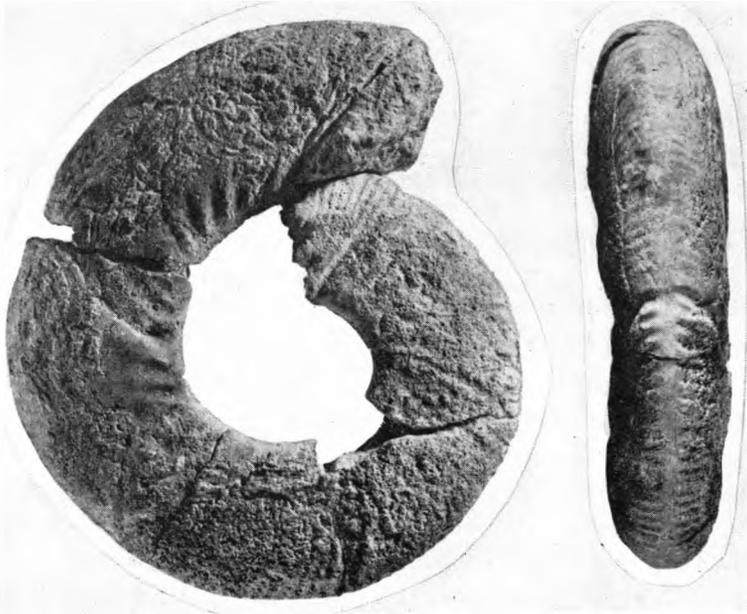
Description of Holotype.—The diameter is 66 mm. but there is only $\frac{1}{4}$ whorl of body-chamber, and so another half-whorl at least is missing. Septa cease at about 55 mm.

At 50 mm. the dimensions are $\cdot 45$, $\cdot 34$, $\cdot 24$. The size and coiling are as in *M. patescens* but the ribbing is finer and the whorl shape at all stages is 10 per cent. more compressed (e.g., $\cdot 34$ instead of $\cdot 44$ at 50 mm.).

Remarks.—I designate Thalmann's figured specimen lectotype of *M. angelomontanense*: it is evidently the middle syntype of which the dimensions are listed. There is close agreement with the holotype of *M. macrescens*.

In side view *M. macrescens* closely resembles *M. multiforme* (cf. Plate XVI, fig. 1a, and Plate XVII, fig. 3), but *M. macrescens* is much more compressed when seen in ventral view.

The septum drawn at the end of d'Orbigny's pl. 124, fig. 6, implying that the specimen in fig. 5 is wholly septate, is probably imaginary, as in other instances in the 'Paléontologie française.'



TEXT-FIG. 48.—*Morphoceras densicostatum* Thalmann. Zigzag Zone, Kingswood School, Bath (SM. J24664). A squeeze of the impressed area of this specimen is shown in Plate XVII, fig. 4. (Natural size.)

Distribution.—Zigzag Zone: Broad Windsor, Dorset (holotype, GSM. 47172; also GSM. 3641); Vitney Cross, Dorset (a variety, GSM. Y3759); Burton Bradstock cliff (Bomford Coll. 1963, 3895—6); Lodors Cross, SW. quarry (author's coll., now Bomford Coll. 3786). Switzerland: Lower Bathonian, Stoffelberg, in the same beds as *M. multiforme*. Sicily: Monte Inici (H. R. Warman Coll.).

4. *Morphoceras densicostatum* Thalmann. Plate XVII, fig. 4; Text-fig. 48.

Morphoceras polymorphum d'Orb., var. *densicostatum* Thalmann, 1925, p. 26 (not figured).

Original Description.—“ Among the numerous examples of *M. polymorphum* d'Orb., there are some individuals which, relative to their size, possess a very wide and step-

shaped umbilicus, and whose ribs are much finer, weaker, and closer together. Although these specimens belong within the form-orbit [Formenkreis] of *M. polymorphum*, yet I believe that I am justified in introducing them as a new variety on account of their characters, since I know no figures or descriptions of such fine-ribbed, evolute forms of *polymorphum*. Occurrence: In the main *Morphoceras polymorphum* level of the Lower Bathonian at Stoffelberg [Switzerland].”

Description of English Specimen.—An internal cast consisting of the complete body-chamber, which occupies just a whorl. At one end is the last suture, at the other the peristome. The diameter is 81 mm. At 75 mm. the dimensions are .335, .25, .40. The septate whorls are missing, but their ventral aspect is shown by a squeeze taken from the impressed area of part of the body-chamber (Plate XVII, fig. 4). The ribbing is fine, typical of *Morphoceras*, fading on the whorl-sides on the last half-whorl, but persisting at the ventral and umbilical edges. Counting the final one, there are five deep, narrow, curved and strongly prorsiradiate constrictions. The whorl-shape is compressed, the coiling evolute for the genus. The aperture is apparently simple, bordered by a constriction no different from its predecessors.

Comparisons.—The nearest figured *Morphoceras* seems to be the form from Privas figured as *M. polymorphum* by Roman (1935, p. 30, pl. v, fig. 1), which has the open umbilicus and smooth outer whorl; but the Kingswood School specimen is much more evolute and larger, retaining traces of ribbing much longer. A somewhat intermediate form has been sent me by Dr. P. L. Maubeuge from the Caillasses à *Anabacia* of Onville, Meurthe et Moselle, France. Differs from *M. macrescens* by its finer ribbing and more discoidal shape.

Distribution.—Zigzag Zone: Kingswood School, Bath, excavation for hockey pitch, 1949, A. B. Sackett Coll. and author's Coll. (SM. J24664). (The inner parts were collected by the Headmaster, Mr. A. B. Sackett; the missing last quarter whorl was picked up by me when he showed me the site several weeks later.) Type from Stoffelberg, Switzerland.

5. *Morphoceras pingue* de Grossouvre. Text-fig. 49.

Morphoceras pingue de Grossouvre, 1919, p. 391, pl. xiv, fig. 7.

Description and Comparisons.—Inner whorls unknown. Middle stage stout, with rounded-quadrate whorls, extremely deep and arcuate constrictions, and ribbing which tends to frequent twinning of the primaries from a slightly raised common stem at the umbilical margin. De Grossouvre described these raised bases of the bifurcating or twinned primaries as “little tuberoles.” Secondary ribs are fine, dense and delicate, without appreciable ventral interruption.

Thanks to Brigadier Bomford's collecting on the Dorset coast, this species can now be added to the English list. There is also comparable but not identical material from the Zigzag Zone of Sicily, collected in 1952 by Mr. H. R. Warman.

Distribution.—Zigzag Bed, Burton Bradstock (Bomford Coll. 1325). Holotype from the Lower Bathonian, Sainte-Pezenne, Nièvre. ? Sicily, Monte Inici (H. R. Warman Coll.).

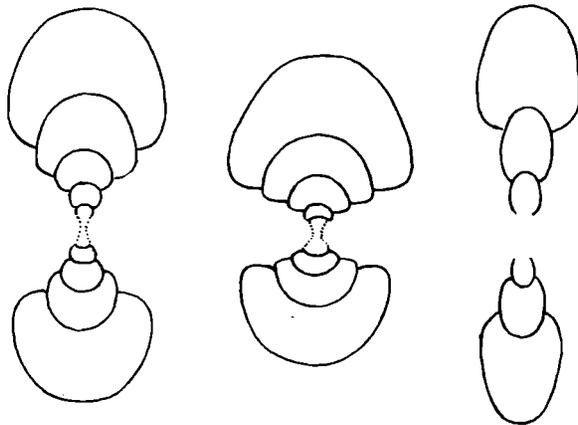
6. *Morphoceras repletum* (S. Buckman). Plate XVI, figs. 5, 9, 10; Text-fig. 50.

Polysphinctites repletus S. Buckman, 1922, TA, iv., Pl. CCCLIX.

Description.—Nucleus evolute, serpenticone, smooth, gradually becoming delicately ribbed, repeatedly and deeply constricted. Whorl-section depressed, later round. As growth proceeds, ribbing becomes more pronounced and coiling becomes more involute, before opening out again in the last whorl. Middle and outer whorls



TEXT-FIG. 49.—*Morphoceras pingue* de Grossouvre. Left, reproduction of original figures. Right, Zigzag Bed, Burton Bradstock (Bomford Coll. 1325).

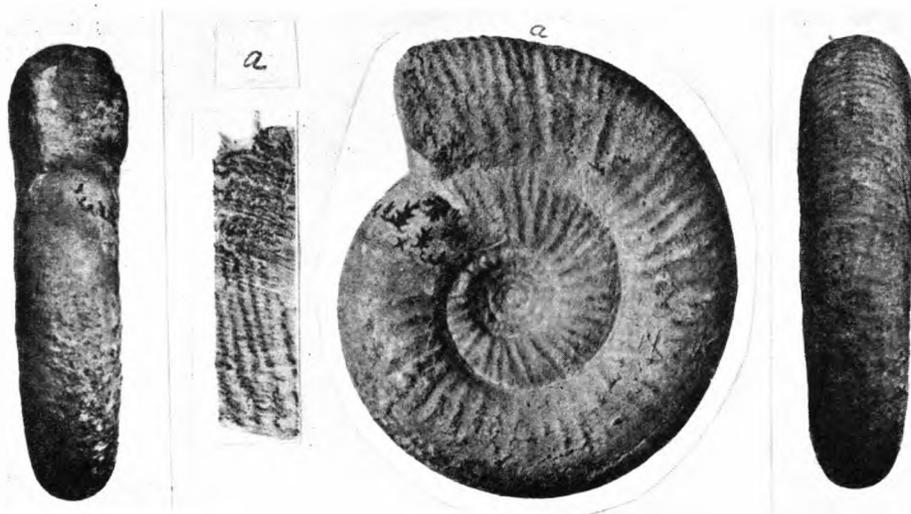


TEXT-FIG. 50.—Cross-sections:—left: *Morphoceras repletum* (Buckman), holotype, GSM. 47159; centre: *Morphoceras multiforme* Arkell, Burton Bradstock, SM. J28881; right: *Polysphinctites polysphinctus* Buckman, topotype, Burton Bradstock, GSM. 72829. The drawings in left and centre are from sectioned specimens, that on right is from measurements of the exterior (and therefore of a lower degree of fidelity). $\times 1.5$.

ribbed as in typical *Morphoceras*, but ribbing not interrupted on the venter except on the nucleus.

Comparisons and Remarks.—In some respects this species is intermediate between *Morphoceras* and *Polysphinctites*. Buckman assigned it to *Polysphinctites* on account of its smooth and evolute inner whorls, which in side view are very like those of *P. polysphinctus* (see Plate XVI, fig. 5). Spath (1928, p. 254; 1931, p. 281) referred it to *Morphoceras*, with which the middle and outer whorls are identical. Cross-section-

ing of the holotype (Text-fig. 50) proved that in this instance Buckman's development of the umbilicus had been accurately performed and that the nucleus is in fact identical with the almost smooth, evolute nucleus figured on Plate XVI, fig. 5. Nevertheless, comparison of the cross-sections of *M. replictum*, *multiforme* and *P. polysphinctus* (Text-fig. 50) supports Dr. Spath's contention that *replictum* is closer to *multiforme* and a true *Morphoceras*. It might be suggested that a new subgenus is needed for *replictum* on account of the contrast between its perisphinctoid nucleus and the olcostephanoid nucleus of true *Morphoceras* (as figured, for example, by Roman, 1933, pl. ii, fig. 17). Comparison of the cross-sections (Text-fig. 50), however, shows that the difference is merely one of degree, and that the true line of division falls between *replictum* and *polysphinctus*, which is at all stages much more evolute and compressed.



TEXT-FIG. 51.—*Morphoceras recinctum* (Buckman). Holotype, Fuller's Earth, Midford. Original figures after Buckman.

On one side, part of the outer whorl of the holotype of *M. replictum* and of a larger chorotype (Plate XVI, figs. 9a, 10b) shows the peculiar V-shaped branching of the primary ribs near the umbilical margin which was pointed out by de Grossouvre as a special feature of *Morphoceras pingue*. *M. pingue* is closely allied and *M. replictum* is now kept separate mainly because it is less inflated, and because the inner whorls of *M. pingue* are unknown. *M. parvum* Wetzel (1937, pl. xiv, fig. 6, lectotype now designated) is also close but still more compressed.

Distribution.—Zigzag Bed: Burton Bradstock (holotype, GSM. 47159; Bomford Coll. 3888, 3890); Burton Bradstock allotments quarry (Channon Coll.); Crewkerne station (BM. C41430).

7. *Morphoceras recinctum* (S. Buckman). Text-fig. 51.

Morphoceras transylvanicum de Grossouvre, 1919, p. 390, pl. xv, figs. 1, 2 (non Simionescu?).

Asphinctites recinctus S. Buckman, 1924, TA, v, Pl. CDLXXXIV.

Description and Remarks.—The holotype is presumed destroyed by the bombing

of Bristol Museum in 1942 and no other material is available. Buckman's figures show an evolute, perisphinctoid *Morphoceras*, which seems hardly distinguishable from *M. replictum* except in the one feature of almost total absence of constrictions. On account of this Buckman coined for it the genus *Asphinctites*; but at least one shallow constriction is visible on the type figure, about four ribs behind the aperture. It may be doubted, in fact, whether the nearly complete suppression of constrictions is more than an individual peculiarity in this instance, although de Grossouvre's figures show that unconstricted individuals occur also in France.

The drawing of a fragment which is the type of *Perisphinctes transylvanicus* Simionescu (1905, pl. ii, fig. 3) requires more material for interpretation.

Distribution.—Fuller's Earth, Midford, Somerset (holotype, lost). France: Lower Bathonian, Nièvre.

Genus **POLYSPHINCTITES** S. Buckman (see p. 131).

1. **Polysphinctites polysphinctus** S. Buckman. Plate XVI, figs. 6, 7, 8; Text-fig. 50.

Polysphinctites polysphinctus S. Buckman, 1922, TA, iv, Pl. CCCXXII, A-C.

Description.—See above, under the genus, p. 131. The holotype is not full-grown. A well-preserved complete topotype (GSM. 72829, Plate XVI, fig. 8) has nearly a whole extra whorl and shows the peristome with part of a lappet. It is 39.5 mm. in diameter, at which the dimensions are .305, .23, .44. The body-chamber is believed to occupy a whole whorl. It is finely ribbed to the end; and on the venter, although ribbing becomes very faint, there is no definite smooth band.

In Text-fig. 52 is shown an extraordinary ammonite collected by Brigadier Bomford in 1953 in the Zigzag Bed at Burton Bradstock. It resembles *P. polysphinctus* in every character except that it possesses a keel, which is strong on the first part of the whorl but gradually becomes feebler. A new genus and family could be erected for it, but in the absence of other material it is believed to be a freak specimen of *P. polysphinctus*, comparable with a keeled *Ataxioceras* figured by de Loriol (1876-8, 'Mém. Soc. pal. Suisse,' iii, pl. x, fig. 10).

Distribution.—Zigzag Zone: Burton Bradstock (holotype, GSM. 47133; GSM. 72829; BM. C4208 with *Lissoceras psilodiscus* in same piece of rock, see p. 49); Bomford Coll. 3787, 3889). Broad Windsor (paratype, GSM. 47135).

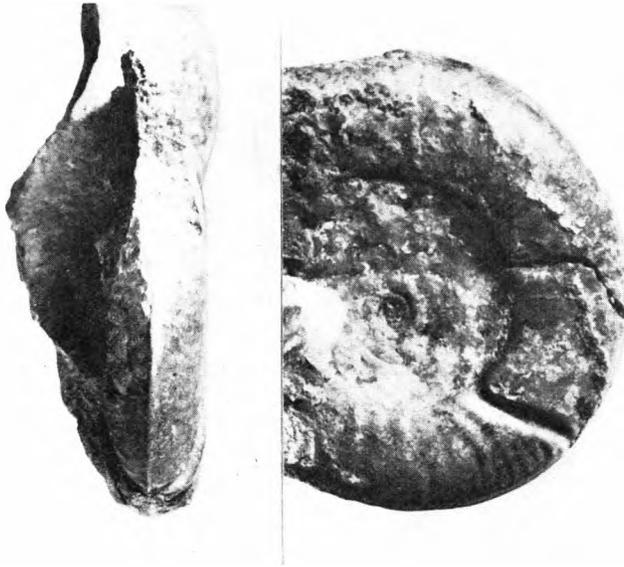
2. **Polysphinctites ebrayoides** sp. nov. Plate XVI, fig. 3.

Description of Holotype.—Max. diameter 46 mm. An evolute, compressed form. The nucleus shows clearly and is evolute, smooth and deeply constricted, as in *Polysphinctites polysphinctus*. The ribbing on the middle whorls is feeble, rursiradiate, and branches from the umbilical margin as in *Ebrayiceras*. The outer half-whorl becomes almost smooth and tends to coil more loosely, as in *Morphoceras*. Constrictions become feebler as growth proceeds. Venter not clearly visible. Sutures unknown.

Comparisons.—This species is a remarkable mixture of *Morphoceras*, *Ebrayiceras* and *Polysphinctites*, and is evidence that all three genera are intimately related and connected. Nuclei would be classed as *Polysphinctites*, parts of middle whorls as *Ebrayiceras*, and an outer whorl as *Morphoceras*.

Morphoceras egrediens Wetzel (1937, p. 131), based on Quenstedt, 1886, pl. lxxiv, fig. 1, is as compressed, but much more involute.

Distribution.—Lark Hill, Burton Bradstock (presumed Zigzag Bed) (holotype, Buckman Coll., B.M. C41448).



TEXT-FIG. 52.—Problematic ammonite : keeled *Polysphinctites*? Zigzag Bed, Burton Bradstock (Bomford Coll. 6320).
× 2.

Genus **EBRAYICERAS** S. Buckman (see p. 131).

1. **Ebrayiceras pseudo-anceps** (Ebray). Plate XVII, fig. 7–11.

Ammonites pseudo-anceps Ebray, 1864, p. 263.

Ammonites (Morphoceras) pseudo-anceps H. Douvillé, 1880, p. 239.

Morphoceras pseudo-anceps de Grossouvre, 1919, p. 390.

Ebrayiceras pseudo-anceps S. Buckman, 1920, TA, iii, p. 23, Pl. CLXXIV.

Ebrayiceras ocellatum S. Buckman, *ibid.*, Pl. CLXXIII.

Morphoceras pseudo-anceps Riche & Roman, 1921, p. 150, pl. vii, fig. 5.

Morphoceras (Ebrayiceras) pseudo-anceps Thalmann, 1925, p. 21, fig. 1, a–e.

Morphoceras (Ebrayiceras) pseudo-anceps Roman, 1933, p. 64, pl. ii, figs. 10–12.

Description and Remarks.—The maximum diameter of English material known to me is 33 mm. and the length of the body-chamber does not much exceed half a whorl. There is great variability in the strength and angle of projection of the ribbing, and to a minor degree in width of umbilicus. I agree with Thalmann's remarks: "the species seems to be polymorphic: the umbilicus varies in width in different individuals,

the ribs can be coarser or finer, crowded together or strongly projected." Nor do the differences in the apertural parts pointed out by Buckman necessarily or probably denote specific differences. He says of *E. ocellatum* that it has "mouth with ocular and brachial apertures open," as compared with *E. pseudo-anceps* which has "mouth re-opened in front and side-apertures sealed." Uhlig (1882) drew attention to a number of apertural peculiarities of this kind which vary profoundly from one individual to another within the species.

Roman (1933) has described and figured varieties comparable with those in the Zigzag Bed of Burton cliff from the same horizon at Jebel es-Sekika in Algeria. His conclusions as to the range of variation of the species agree independently with Thalmann's.

It is easy to sort well-cleaned adult material into compressed and more tumid varieties, corresponding with Buckman's two species *ocellatum* and *pseudo-anceps*, but with more numerous material many intermediate and doubtful specimens become apparent, and I cannot believe that two species are represented.

M. gignouxii Guillaume (1928a, p. 217, fig. 1), from the Middle Bathonian of Normandy, resembles some fine-ribbed varieties of var. *ocellatum* Buckman, but is smaller and has the ribs more projected on nearing the venter.

Distribution.—Zigzag Bed: Burton Bradstock cliff, common (Bomford Coll., 1316, 1913, 1967, 3920, 3921, 3914; author's Coll.; also ("*ocellatum*") Bomford Coll. 2859, 3206, 3910—3913, 3916, 3918). Broad Windsor and Crewkerne Station (figd. Buckman, GSM. 32020 (type of *ocellatum*), 32021, 3567). Also from all these places, not localized stratigraphically, Buckman Coll., BM (C35902, C35917, C35924, C41431, etc.). Piplely Farm, Upton Cheyney, nr. Bitton, nr. Bristol, from disturbed beds about 4 ft. below Fuller's Earth (Fry Coll., Bristol Univ.). France, generally distributed in the Zigzag Zone. Also in Switzerland, Swabia, Morocco, Algeria (Jebel es-Sekika and El Harchaia), and Persia (Elburz Mts.).

2. *Ebrayiceras rursum* S. Buckman. Plate XVII, figs. 14, 15.

Ebrayiceras rursum S. Buckman, 1927, TA. vii, Pl. DCCLVIII.

Description and Remarks.—The holotype is 29 mm. in diameter and might be considered an abnormal individual of *E. pseudo-anceps*, but there is one other specimen like it, and therefore it may be a good species. It differs from *E. pseudo-anceps* and all its varieties in its more evolute coiling and coarser, more rursiradiate ribbing; and the shell as a whole is more compressed.

In no English material has ribbing been seen so coarse as in the German *E. sulcatum* Zieten sp. (Schloenbach, 1865, pl. xxviii, figs. 5a, b); still less as in the extremely coarse-ribbed and evolute Algerian species *E. gautieri* Roman (1933, p. 67, pl. ii, fig. 14, lectotype now designated). The ribbing is prorsiradiate in both *E. sulcatum* (Zieten) and *E. problematicum* Gemmellaro sp. (1877, p. 145, pl. xix, fig. 1) from Sicily. In view of the invariable association of the two genera in the rest of Europe and in North Africa and Persia, it is curious that at the locality whence Gemmellaro obtained

PLATE XVI.

FIG.		PAGE
1a, b, 2a, b.	<i>Morphoceras multiforme</i> Arkell. Broad Windsor, Dorset (BM. C35912, GSM. 24714).	132
3.	<i>Polysphinctites ebrayoides</i> sp. nov. Holotype, Lark Hill, Burton Bradstock (BM. C41448).	138
4a, b, c.	<i>Morphoceras macrescens</i> (S. Buckman). Holotype, Broad Windsor (GSM. 47172).	133
5a, b.	<i>Morphoceras replictum</i> (S. Buckman), nucleus, Burton Bradstock (Bomford Coll. 3888) (see also figs. 9, 10).	136
6, 7, 8.	<i>Polysphinctites polysphinctus</i> S. Buckman. 6, Broad Windsor ; figured by Buckman (GSM. 47135). 7, holotype, Burton Bradstock (GSM. 47133). 8, Burton Bradstock (GSM. 72829).	138
9a, b, 10a, b.	<i>Morphoceras replictum</i> (S. Buckman). 9a, b, Crewkerne station (BM. C41430). 10a, b, holotype, Burton Bradstock (GSM. 47159) (see also fig. 5).	136

All photos natural size.



1a



1b



3



2a



2b



4a



4c



4b



5a



5b



6a



6b



7a



8a



8b



9a



9b



7b



10a



10b

PLATE XVII.

FIG.	PAGE
1 <i>a, b</i> , 2 <i>a, b</i> . <i>Ebrayiceras jactatum</i> S. Buckman. 1 <i>a, b</i> , Broad Windsor (BM. C35921). 2 <i>a, b</i> , holotype, Burton Bradstock (GSM. 49343) (see also figs. 12, 13).	141
3. <i>Morphoceras macrescens</i> (S. Buckman). Broad Windsor (GSM. 3641).	133
4. <i>Morphoceras densicostatum</i> Thalmann, squeeze of impressed area of outer whorl figured in Text-fig. 48, Kingswood School, Bath (SM. J24664).	134
5 <i>a, b</i> . <i>Morphoceras patescens</i> (S. Buckman), holotype, Broad Windsor (GSM. 47151).	133
6 <i>a, b</i> . <i>Ebrayiceras filicosta</i> Wetzel. Quarry S. of Yeovil Junction station (GSM. VW1171).	141
7--11. <i>Ebrayiceras pseudo-anceps</i> (Ebray). 7 <i>a, b</i> , holotype of <i>E. ocellatum</i> S. Buckman, Broad Windsor (GSM. 32020). 8 <i>a, b</i> , specimen figured by Buckman, Crewkerne station (GSM. 32021). 9, Grange Quarry, Broad Windsor (BM. C35924). 10, Broad Windsor (BM. C41431). 11, fine-ribbed specimen, Crewkerne (GSM. 3567).	139
12, 13. <i>Ebrayiceras jactatum</i> S. Buckman. Burton Bradstock (BM. C30911) and Broad Windsor (BM. C35920) (see also figs. 1, 2).	141
14 <i>a, b</i> , 15. <i>Ebrayiceras rursum</i> S. Buckman. 14 <i>a, b</i> , holotype, Burton Bradstock (GSM. 49337). 15, Burton Bradstock (GSM. 3643).	140

All photos natural size.



1a



2a



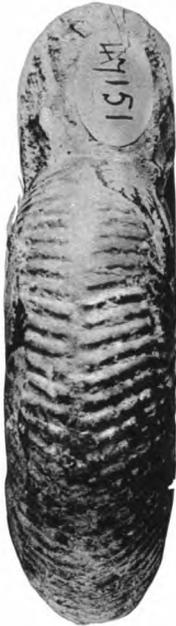
2b



1b



3



5a



5b



6a



4



6b



7a



7b



8a



8b



9



10



11



12



13



14a



14b



15