THE FOSSIL FAUNA OF THE SAMANA RANG AND SOME NEIGHBOURING AREAS.

PART V.

THE LOWER CRETACEOUS AMMONOIDEA WITH NOTES ON ALBIAN CEPHALOPODA FROM HAZARA.

BY

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(With Plates VIII and IX.)

1. INTRODUCTION.

THE following account is based primarily on the small but interest suite of ammonoids collected by Col. Davies in the topmost grits his main sandstone series (bed No. 4 of his stratigraphical account in part The state of preservation of these forms, of undoubted Albian age, is from satisfactory, except in the case of a few examples of *Douvilleicer* but what strikes the observer at once, on examining these Gault fossils, their great resemblance, in preservation and matrix, to the similarly phosphati ammonites from the *mammillatum* bed in Kent. The assemblage, howev is that of corresponding deposits in more southern latitudes. Ribbed d moceratids are very rare in the English Lower Gault, and no example *Brancoceras* has yet been found. The latter is generally associated wi *Lyelliceras*, and in England this seems confined to the *benettianus* zone (n developed in Kent), and has only been found during the last few years the pre-*dentatus* Gault of Warminster, Wilts, and Bonchurch, Isle of Wigl The genus *Pictetia*, represented in the Samana material by a poorly preserv fragment, is however, again confined to the lowest Gault (*mammillatum dentatus* zones), as is also *Protanisoceras*.

The desmoceratids and the single hamitid are not of use for finer zonin but there is one poorly preserved fragment, referred to below as perhaps portion of a large *Douvilleiceras*, that could possibly belong to a *Hypaca thoplites* (*milletianus* group) of Lower Albian age. Another fragment of *Hysteroceras* at first sight suggests comparison with the common forms (this genus at the top of the Lower Gault, but since similar species mus have existed already in the *cornutum* zone or earlier, and since the dipol ceratids are absent from the earlier half of the English Lower Gault, thi fragment also cannot be dated with accuracy.

Apart from these two doubtful fragments, then, that could be higher o lower in the Albian sequence, we have the great majority of ammonites sug

gestive of the zones of the writer's Hoplitan age, *i.e.*, the lower part of the English Lower Gault. Col. Davies also points out that *Douvilleiceras mammillatum* is by far the commonest of the ammonites and that many more examples could have been collected. It is not probable, however, that the ammonites of this thin, conglomeratic, bed represent the fauna of a single horizon; and like other phosphatic nodule beds with glauconite and large quartz grains, this condensed stratum probably contains relics of various Lower Gault zones. This opinion is supported by an examination of the large collection of Albian ammonites from Hazara, sent to the writer by the kindness of the Director of the Geological Survey of India. In view of their importance and the fact that Dr. Cotter, in a recent note,[1] only referred to a few of the forms represented, it has been considered advisable to incorporate in the present account the results of a detailed examination of the Hazara ammonites which include higher horizons in the Albian sequence.

The isolated Neocomian specimen from the Belemnite bed on Kadimak mountain, just north of Thal, is of geological interest since the belemnites in the same stratum are quite indeterminable and like the similarly weathered specimens from the presumably equivalent beds of Samana are insufficient to date these deposits.

2. DESCRIPTION OF SPECIES.

A. Albian of the Samana range.

Family: *LYTOCERATIDAE*, Neumayr emend.

Sub-family: HEMILYTOCERATINAE, Spath.[2]

Genus: Pictetia, Uhlig.

Pictetia cf. astieriana (d'Orbigny).

1923. Spath, 'Ammonites of the Gault'; *Monogr. Pal. Soc.*, (vol. for 1921), p. 27, pl. i, figs. 7*a*, *b*.

A fragment (14,481) showing costation like the example figured in 1923, is probably specifically identical with the Folkestone specimens, but on account of its very poor state of preservation the determination must be provisional.

In England, this species has not been found outside the *dentatus* zone, but the closely allied *Pictetia depressa* occurs in the *mammillatum* zone in Surrey and the earlier *regularis* and *tardefurcata* zones in more southern deposits.

Family: *DESMOCERATIDAE*, Zittel.

Genus: Desmoceras, Zittel emend. Grossouvre.

Desmoceras latidorsatum (Michelin).

1923. Spath, 'Ammonites of the Gault'. *Monogr. Pal. Soc.*, (vol. for 1921), p. 39, pl. ii, fig. 2.

A septate fragment (14,482) with the suture-line well displayed is undoubtedly referable to this species. The whorl-section is not so depressed as in *D.*

[1] 'The Distribution of the Gault in India.' *Rec., Geol. Surv. Ind.*, vol. LIX, pt. 4 (1926), 1927, p. 405.

[2] "Revision of the Jurassic Cephalopoda of Kachh (Cutch)". *Pal. Ind.*, N. S., vol. IX, No. 2, fasc. 1 (1927), p. 64.

obesum (Reynes) Spath[1] with which I also included the inflated variety *a* of *D. latidorsatum* in Kossmat and Jacob. These forms have an extended vertical range and are especially common in Mediterranean countries. Even in England they are known, if only in isolated examples, from the Lower Gault of Folkestone, the Cambridge Greensand, and in one gigantic example, lately collected by Mr. T. F. Grimsdale, from the Lower Cenomanian of Seaton, Devon. Elsewhere, however, *D. latidorsatum* occurs already in the *tardefurcata* zone of the Lower Albian.

The small Hazara example here figured (pl. VIII, fig. 3) although more complete, is less well preserved and corroded. It shows, however, the characteristic faint constrictions.

Family: *CLEONICERATIDAE*. Whitehouse.

Cleoniceras daviesi, sp. nov. (Pl. VIII, figs. 17*a*—*c*.).

Although the holotype here figured (pl. VIII, figs, 17*a*—*c*) is corroded, and septate to the end, with only small portions of the suture-line accessible for study, its whorl-shape and ornamentation are sufficiently distinct for specific separation. The whorl-section is compressed, elliptical, with gently rounded sides and arched venter. The region of greatest whorl-thickness is at the inner third, close to the perfectly rounded umbilical wall. This is seen to be costate on the earlier volutions, but entirely smooth on the last half whorl. The ribs are comparatively coarse, slightly flexiradiate, and obsolete on the venter, where, to judge by the accompanying constrictions, they probably united in forwardly directed chevrons. On the last half whorl all costation tends to disappear but one of the periodic constrictions is still visible a short distance from the end of the shell.

Cleoniceras balmense (Jacob)[2] and *Cl. quercifolium*[3] are more coarsely ribbed than the form now described, whilst *Cl. baylei* (Jacob)[4] is more involute and shows ribbing of a different kind. The typical large *Cl. cleon* (d'Orbigny)[5] is more discoidal and tends to sharpen the ventral area already at small diameters. *Cl. rebouli* (Jacob)[6] has smoother inner whorls and its ribs are prominent on the venter. The numerous forms of this group, some as yet undescribed, are represented in all collections by Escragnolles specimens that were included in a comprehensive '*Ammonites dupinianus*, d'Orbigny', the type of which, according to Jacob, belongs to *Beudanticeras* (='*Uhligella*').[7]

[1] 'Sur quelques Ammonites du Gault, nommées par P. Reynès'. *Ann. Muséum Marseille*, vol. XX, 1925, p. 101, pl. iv, fig. 2.

[2] 'Amm. du Crétacé Moyen'. *Mém. Soc. Géol. France*, 1908, p. 33, pl. xiv, figs. 6—9.

[3] See Jacob, *ibid*, p. 59, pl. xix, figs. 3—5.

[4] *Ibid.*, p. 59, pl. xvii, figs. 25*a*, *b*.

[5] Paléont. Française, Ter. Crét., vol. I, 1840, p. 286, pl. lxxxiv.

[6] *Loc. cit.*, p. 32, pl. xiv, figs. 1—3.

[7] Since the genotype of *Uhligella* (Jacob, 1908, p. 26) is *U. walleranti* which belongs to *Beudanticeras* (Hitzel, 1905), the restriction of the genus *Uhligella* to the Aptian *zürcheri*-group (Spath, loc. cit., 1923, p. 38) is inadmissible.

There is superficial resemblance to certain Aptian forms figured by Bonarelli and Nagera[1] as *Beudanticeras* cf. *stoliczkai* and '*Uhligella*' *quercifolia*, but the type of costation is different.

The two small and fragmentary examples figured in pl. VIII, figs. 7*a*, *b* and 8*a*, *b* may be the young of the same or of a closely allied species, but they cannot be more definitely identified on account of their defective preservation. They are less likely to be the young of such desmoceratids as Douvillé's '*Puzosia denisoniana*' from Persia.[2]

CLEONICERAS sp. nov. ? ind. (Pl. VIII, figs. 11*a*, *b*).

The fragmentary example of probably a new species here figured unfortunately does not show a recognisable suture-line. In its whorl-shape and sigmoidal ribbing, with periodic, strengthened primaries and three to four shorter intermediaries, it resembles certain Escragnolles forms in the British Museum (Astier Colln., No. 119) that were labelled *Amm. dupinianus*, d'Orbigny. Jacob[3] pointed out that the latter species has often been mistaken for *Cleoniceras balmense*, but the Samana example here figured might also be taken to be an immature *Beudanticeras*. Thus *B. daintreei*, Etheridge sp.[4], recently discussed by Whitehouse[5], is less coarsely costate, but seems to show no ribs in the umbilicus. It is precisely on account of the distinct primary ribs, resembling those of the English examples of *Cleoniceras baylei* (Jacob) and *C.* ? *devisense*, figured by the writer,[6] that the specimen now discussed is referred to *Cleoniceras* rather than to *Beudanticeras* (='*Uhligella*').

A doubtful fragment of perhaps the same species has been found in Hazara (14,486, pars).

Family: *DOUVILLEICERATIDÆ*, Spath.

Genus: DOUVILLEICERAS, de Grossouvre.

DOUVILLEICERAS MAMMILLATUM (Schlotheim) emend. (Pl. VIII, figs. 12, 16.).

1923. Spath, Mon. Amm. Gault, p. 68, pl. iv, figs. 3*a*, *b*; pl. v, figs. 1—4.
1927. Cotter. *Rec., Geol. Surv. Ind.*, vol. LIX, pt. 4 (1926), p. 406.

Eight examples, of which two are here figured, are referable to this species in its wider sense, for actually there are no two specimens alike, as is the case with all highly-ornamented ammonites. The immature example represented in pl. VIII, fig. 16 has a protracted '*clavatus*' stage, and this is also seen in the dorsal (impressed) area of the typical fragment figured in pl. VIII, fig. 12.

[1] 'Observ. Geolog. en las immed. del Lago San Martin'. *Boll. Minist. Agric., etc., Buenos Aires. Ser. B, Geol.* No. 27, 1921, pl. iii.

[2] In Morgan :—'Mission Scientifique en Perse', vol. III, Études Géologiques, partie IV, Pal. (2) 1904, p. 237, pl. xxix, figs. 1—4.

[3] *Loc. cit.* (1908), p. 34.

[4] Description of Palæoz. and Mesozoic Fossils of Queensland', *Quart Journ. Geol. Soc*, vol. XXVIII, 1872, p. 346, pl. iv.

[5] Cretaceous Ammonoidea of Eastern Australia', *Mem. Queensland Museum*, vol. VIII, pt. 3, 1926, p. 221.

[6] *Loc. cit.* (1923), pl. iv, figs. 6, 7.

Among the 550 Hazara specimens, there are no fewer than 94 examples o *Douvilleiceras*, showing great variability and including forms that, like the speci men figured in pl. IX, fig. 2, are referable to Sowerby's *D. monile*. There ar various transitions, however, with differences in the spacing of the costæ; bu there is nothing that could be compared to *D. inæquinodum* (Quenstedt). A very large but doubtful fragment (14,489) is comparable to the giganti *Douvilleiceras* recorded by myself [1] from Zululand, and to the Okeford Fitzpaine fragment with which the latter was compared.[2] Another very large Hazara fragment (14,490) however, perhaps merely on account of lateral compression, may be more closely allied to *Acanthoplites* Sinzow, and to *Hypacanthoplites*, Spath, which occur in the Lower Albian and include the last parahoplitids.

Family: *PERVINQUIERIDÆ*, Spath.

Genus: HYSTEROCERAS, Hyatt.

HYSTEROCERAS sp. ind. (Pl. VIII, figs. 6*a*, *b*).

The small fragment here figured is too incomplete for correct identification but shows resemblance both to *H. orbignyi* (Spath), the characteristic ammonite of the base of the Upper Albian at Folkestone, and to the new species from the lower *cristatum* zone, previously[3] referred to. These will be described in a future part of the writer's monograph, but meanwhile I may mention that at the Perte-du-Rhône, where the sequence is much more condensed than at Folkestone, M. Ad. Jayet[4] has found *Hysteroceras* of the *orbignyi* type (according to his material kindly forwarded to the writer) together with *Hoplites* of the *præcox-intermedius* group. The latter are confined to a narrow horizon in the Lower Gault and it is clear that Mr. Jayet's bed 37, whence came Pictet's type of *Dipoloceras cornutum*, corresponds to a thickness of 27 feet of the Lower Gault (beds Ia—VIII) at Folkestone. *Dipoloceras* and *Mojsisovicsia* may replace *Oxytropidoceras*, a genus well represented from Hazara; but degenerate dipoloceratids, like the early *Brancoceras* and the later *Hysteroceras*, continue throughout. It is clear that until complete and detailed Mediterranean sections are known comparable to the succession at Folkestone, it is impossible to state at what exact horizon hysteroceratids like the example here figured, first appear. On present evidence its umbilical tubercles suggest an age later than that of the remainder of the fauna.

Genus: BRANCOCERAS, Steinmann.

BRANCOCERAS INDICUM, sp. nov. (Pl. VIII, figs. 9*a*, *b*).

The example here figured (14,492) and a doubtful, smaller fragment (14,493), though perhaps not identical, are more compressed than d'Orbigny's *B.*

[1] 'Cretaceous Cephalopoda from Zululand'. *Ann. South Afr. Mus.*, vol. XII, pt. vii, No. 16, 1921, pp. 220, 303, 304, 315.

[2] Monograph Gault Ammon., *loc. cit.*, I, 1923, p. 71.

[3] Spath, 1925, *Ann. Mus. d'Hist. Nat. Marseille*, vol. XX, p. 98.

[4] Thèse 783, Univ. Genève, 1925, p. 7. These *Hysteroceras*, however, are not listed in his more recent 'Étude Stratigraphique de la Perte-du-Rhône, etc.' *Eclogæ Helvet.*, vol. XX, No. 2, 1926, p. 182.

sequieri[1] and more distantly costate. Parona and Bonarelli[2] mention the occurrence of a more compressed and more involute variety, but their figure (l. xi, fig. 12) shows a much more strongly and closely costate form. In the Astier Collection in the British Museum there are similar examples (*e.g.*, No. 37553*c*) and various transitions to *B. senequieri* and even to the evolute *B. helcion* (Reynès) Spath, discussed below, but there is apparently nothing described from Escragnolles resembling the new Indian form.

This is characterised by its general convergence towards *Lyelliceras seunesi* (Parona and Bonarelli)[3] with the ribs tending to become tuberculate at the middle of the side and the peripheral termination. The delicate costæ, however, in the Indian form, are at first quite like those of immature *B. senequieri* and the venter is sharply keeled except towards the end. The simple suture-line, so far as can be seen, agrees with that of d'Orbigny's species.

B. ægoceratoides, Steinmann[4] with similar suture-line is more inflated and less distinctly keeled.

BRANCOCERAS sp. nov. (Pl. VIII, figs. 18*a*, *b*).

This is undoubtedly a new form of *Brancoceras*, but the preservation is so poor that the discovery of better material must be awaited before it can be named. There is no trace of the suture-line and the inner whorls are replaced by coarsely crystalline calcite. At the diameter of the holotype of the similarly evolute *B. helcion* (Reynès) Spath[5] the whorls are already compressed, but the periphery is too damaged to show whether there was a keel. On the final whorl, which from its glauconitic gritty matrix may be assumed to have belonged to the body-chamber, the ribs are continuous across the rounded ventral area with a forwardly directed sinus.

Family : *HAMITIDAE*, Hyatt emend.

Owing to the unavoidable delay in the publication of the writer's monograph of the Gault Ammonoidea by the Palæontographical Society, the promised[6] revision of this family has not yet appeared, and it may not be out of place to refer here briefly to the views arrived at after several years collecting of hamitids in the English Gault. Dr. Whitehouse has also lately[7] discussed this family, but it seems to the writer that the succession from the Albian *Lechites* and the Cenomanian—Turonian *Cyrtochilus* to the Senonian baculitids is so unbroken that even if they are not strictly monophyletic, their inclusion in one family Baculitidæ is justified. D'Orbigny's *Hamites bouchardianus*,[8] moreover, is probably a fragment of a large *Mastigoceras*. Bœhm[9] according to a more complete

[1] *Loc. cit.* (1842), pl. lxxxvi, figs. 3—5.
[2] 'Foss. Albiani d'Escragnolles'. *Pal. Italica*, Vol. II (1896) 1897, p. 89.
[3] *Loc. cit.*, p. 100, pl. xiv, fig. 9.
[4] 'Tithon und Kreide in den Peruanischen Anden'. *N. Jb. f. Min. etc.*, 1881, pt. II, p. 133, pl. vii, fig. 2.
[5] *Loc. cit.* (Marseille, 1925), p. 98, pl. iv, figs. 1*a*, *b*.
[6] 'Upper Albian Ammonoidea from Portuguese East Africa, etc'. *Ann. Transvaal Mus.*, Vol. XI, pt. 3, 1925, p. 189.
[7] *Loc. cit.* (1926), p. 224.
[8] Pal. Française, Ter. Crét. (I), 1842, p. 540, pl. cxxxii, figs. 11—13.
[9] 'Fauna des Oberen Alb mit *Mastigoceras adpressum*, Sow. sp. bei Ootmarsum (Holland). *Zeitschr. Deutsch. Geol. Ges.*, vol. LXXVII (1925), p. 202.

specimen in the British Museum (No. C4555) and it seems more convenient to retain this as well as *Hemiptychoceras*, Spath (=group of *Ptychoceras gaultinum* Pictet) and *Metaptychoceras*, Spath (=group of *Ptychoceras smithi*, Woods) in the family Hamitidæ. On the other hand we now exclude from this family genera like *Idiohamites*, Spath (=group of *Hamites tuberculatus*, J. Sowerby) and *Hamitoides*, Spath (=group of *Hamites studerianus*, Pictet) which are referable to the families Algeritidæ and Labeceratidæ respectively.

Hamites, *Torneutoceras*, and *Helicoceras*, as Dr. Whitehouse points out, are not names of definite significance although the typical forms are distinct enough. It is probable that the Cenomanian *Hamites* of the type of *H. simplex* d'Orbigny are independent developments, perhaps of uncoiled gaudryceratids, which in the uppermost Albian produced those homœomorphs of the Mæstrichtian *Diplomoceras* that the writer referred to on a previous occasion.[2]

The genus METAHAMITES, gen. nov. (for *Hamites sablieri*, d'Orbigny, 1842. p. 543, pl. cxxxiii, fig. 6), however, is now included in Anisoceratidæ. It is well represented from Hazara, if only by fragments, and several of these are here figured, including an entirely new form (pl. IX, fig. 15) which shows unusual lateral compression and very flattened ribs. Anisoceratids, however, are not monophyletic, just as turrilitids, *via* genera like *Pseudhelicoceras* and *Turrilitoides*, Spath, are derived partly from anisoceratids, partly from the original lytoceratids.

Genus: HAMITES, Parkinson.

HAMITES cf. ATTENUATUS, J. Sowerby.

1814. *Hamites attenuatus*, J. Sowerby, Min. Conchol., vol. I, p. 137, pl. lxi, fig. 4.
1925. *Hamites* sp. ind. Spath, 'Upper Albian Ammonoidea from Portuguese East Africa, etc.,' *Ann. Transv. Mus.*, vol. XI, part 3, p. 189.

Three poorly preserved fragments seem to belong to the *attenuatus* group of true *Hamites*, but two of them have a more rounded whorl-section than the third example. There are, however, a number of better specimens among the Hazara material, including the fragment figured in pl. VIII, fig. 19.

Genus: TORNEUTOCERAS, Hyatt.

TORNEUTOCERAS sp. ind. (Pl. VIII, figs. 10*a*, *b*).

The small fragment (14,496) here figured and a still more doubtful example (14,497) of only half its length, are close to the *Hamites* figured by d'Orbigny as *H. attenuatus* (non Sowerby)[3] which is the genotype of Hyatt's genus *Torneutoceras*. In the lower part of the British Lower Gault, forms of this genus are rare and *Hamites* (*attenuatus*, Sowerby) and *Helicoceras* are dominant. At Hazara, however, a number of fragments of *Torneutoceras*, comparable to the Samana form,

[1] *Loc. cit.* (1842), p. 550, pl. cxxxiv, figs. 12—14.
[2] *Loc. cit.* (Zululand, 1921), p. 257.
[3] *Loc. cit.* (1842), pl. cxxi, fig. 9.

have been collected, apparently in the Lower Gault. One slightly crushed specimen is figured in pl. IX, fig. 14 but there are also fragments of forms of *Protanisoceras*, like *P. blancheti* (Pictet and Campiche)[1] and *P. vaucherianus* (Pictet)[2] in which the peripheral tuberculation, owing to the poor state of preservation, is scarcely visible.

Genus: PROTANISOCERAS, Spath.

PROTANISOCERAS sp. ind. (Pl. VIII, figs. 14*a*—*c*).

The small Samana example (14,501) here figured with its regular, peripherally bituberculate, ribs resembles species of *Protanisoceras* like those figured by Pictet and Campiche (loc. cit. 1861) in plates xlvi and xlvii, especially fig. 8 of the latter; also *P. halleri* (Pictet and Campiche)[3], but it is rather too small to be definitely identified. Among the Hazara material there are some fragments comparable to *P. raulinianus* (d'Orbigny),[4] or rather the bituberculate varieties of figs. 10—11.

Sommermeier[5] recorded a fragment of *P. blancheti* from Peru (Parishuanca), also associated with *Douvilleiceras mammillatum*.

B. NEOCOMIAN OF THAL.

Family: *OLCOSTEPHANIDAE*, Spath, 1924.[6]

Genus: OLCOSTEPHANUS, Neumayr.

OLCOSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. (Pl. VIII, figs. 1*a*, *b*).

1875. *Perisphinctes astierianus* (d'Orbigny) Waagen: Jurass. Cephalop. of Kutch. *Pal. Ind.*, ser. IX, No. 4, p. 245.

The single Thal example so far collected is unfortunately badly preserved but it seems to be closely allied to, if not specifically identical, with the two slightly less globose Chichali specimens here figured (pl. VIII, figs. 4, 5). They differ mainly in their slightly closer primary ribs from another Salt Range (Kalabagh) specimen in the British Museum (Dr. Fleming Colln.) that cannot be distinguished from the immature '*Astieria*' *astieri* (d'Orbigny) figured by Baumberger.[7] It is probable that some of the Indian forms are new and the Samana example certainly cannot be definitely identified with any of the Swiss and French forms dealt with by Baumberger and Wegner,[8] whilst such North German forms as *Rogersites psilostomus* (Neumayr and Uhlig) and the few Speeton forms described by the writer are perhaps even less closely comparable.

[1] 'Descr. Foss. Ter. Crét. Ste. Croix'. II, Pal. Suisse, sér. III, 1861, pl. xlvii.

[2] *Ibid.*, pl. xlvi, figs. 1—4.

[3] *Loc. cit.* (1861), pl. liv, figs. 1—5.

[4] *Loc. cit.* (1842), pl. cxxxiv, figs. 5—11.

[5] "Fauna des Aptien und Albien im nördlichen Peru"; in Steinmann: *Beiter. Geol.* und *Pal. Süd Amer.* XV. *N. Jb. f. Min., etc.* Beil. Bd. XXX, 1910, p. 377.

[6] 'Ammonites of the Speeton Clay and Sub-divisions of the Neocomian'. *Geol. Mag.*, 1924, p. 89.

[7] 'Ammoniten der Unt. Kreide im Westschweiz. Jura'. Pt. 4. *Abhandl. Schweiz. Pal. Ges.*, vol. XXXIV, 1907, p. 28, text-fig. 106.

[8] 'Revision *Astieria*'. *N. Jb. f. Min., etc.*, 1909, pt. I, pp. 77—92, pls. xvi—xvii.

Considering the imperfect preservation of the Thal example, it may suff to state that it shows resemblance to one of the varieties of *O. astierianus* figur by Bayle.[1] This has since been separated by Wegner [2] as *O. sayni*, var. *globulos* but the typical *O. sayni*, Kilian, as figured by Baumberger [3] is less close and app. rently has less oblique primary costæ than the Chichali example figured in p VIII, fig. 5. *O. multistriatus* (Zwierzycki)[4] is more involute whilst the sam author's *O. frequens* [5] is more finely ribbed. Among the Crimean forms figure by Karakasch,[6] '*Holcostephanus* (*Astieria*)' cf. *atherstoni* (Sharpe), later [7] rename '*Astieria*' *sharpi*, but identified by Kilian and later authors with *O. guebhardi*, belongs to the earlier group of forms and is less finely costate.

The interest of the present form, moreover, lies in the fact that it enables us to date the Belemnite beds of Thal as of Neocomian age. In a previous paper[9] I showed that *Polyptychites* and the crassicostate *Rogersites* of the Polyptychitan and Hoplitidan ages of the Valanginian, then *Olcostephanus* (=*Astieria*) and its derivative *Subastieria*,[10] of the Lower and Upper Lyticoceratan, belonged to four successive faunas; and Böse[11] in Mexico recorded a sequence similar to that deduced from an analysis of the Speeton fauna. The lower part of his beds with '*Astieria*' *astieriformis* corresponds to my Hoplitidan age, whilst their upper part and his beds with '*Astieria*' *neohispanica* are probably the equivalents of at least the lower portion of my Lyticoceratan age, although he includes them all in the Valanginian. The Thal *Olcostephanus* indicates the fauna of the lowest Hauterivian, or 'zone of *Acanthodiscus radiatus*' in the wider sense, *i.e.*, the Hauterivian Marls of the western Swiss Jura.[12] This fauna is also widely distributed outside Europe, *e.g.*, from Morocco and Tunis to East Africa and Madagascar, but the Uitenhage fauna of South Africa is of slightly earlier date. The glauconitic beds with belemnites and '*Hoplites neocomiensis*' of the Salt Range[13] whence came the *Olcostephanus* above referred to, are undoubtedly of corresponding age and they are similarly succeeded by a white sandstone. The '*Holeostephanus*' (*Astieria*) of the group of *atherstoni*, Sharpe, recorded by Spitz[14] from the Himalayan Giumal sandstone, on the other hand, if correctly identified, would be of Upper Valanginian age.

[1] Explic. Carte Geol. Dét. France. *Atlas*, 1878, pl. lv, fig. 3.

[2] *Loc. cit.* (1909), p. 80.

[3] *Loc. cit.*, pt. 5 (1908), p. 1, pl. xxv, figs. 1*a*, *b*, 2.

[4] 'Cephalopoden fauna der Tendaguru Schichten in Deutsch-Ost Afrika' *Wiss. Ergeb. Tendaguru Exped.* 1909—12, vol. III, pt. 4 (1914), p. 53, pl. vi, figs. 6—9, 16.

[5] *Ibid.*, pl. VI, figs. 1—5, 10—11, 14—15.

[6] 'Description de quelques Céphalopodes du Crét. Inf. de la Crimée' in 'Note sur le Crét. Inf. de Biassala'. *Trav. Lab. Géol., Univers. Grenoble*, vol. VI, 1902, p. 103, pl. i, fig. 3.

[7] 'Le. Crét. Infér. de la Crimée et sa faune'. *Trav. Soc. Imp. Nat. St. Pétersbourg*, vol. XXXII, livr. 5, 1907 p. 123.

[8] See Wegner, *loc. cit.*, p. 37.

[9] *Loc. cit.* (1924), table to p. 80.

[10] This includes the East African *Subastieria dacquei* (Krenkel, 'Untere Kreide von Deutsch Ostafrika'. *Beitr. Pal. Geol. Oesterr. Ungarn*, vol. XXIII, 1910, p. 225, pl. xxii, fig. 6).

[11] 'Algunas Faunas Cretacicas de Zacatecas, etc.' *Boll. Inst. Geol. Mexico*, No. 42, 1923, table to p. 40.

[12] Baumborger, *loc. cit.*, pt. 6 (1910), pp. 44—45.

[13] E. Koken, 'Kreide und Jura in der Saltrange'. *Centralbl. f. Min., etc.*, 1903, p. 442. See also Spitz: 'Lower Cretaceous Fauna from the Himalayan Giumal Sandstone, etc.' *Rec. Geol. Surv. Ind.*, vol. XLIV (1914), p. 213.

[14] *Loc. cit.* (1914), p. 204.

3. OBSERVATIONS ON THE ALBIAN AMMONOIDEA.

The twenty-five Samana ammonoids in Col. Davies's collection above described as of Albian age belong to the following species :—

Pictetia cf. *astieriana* (d'Orbigny).
Desmoceras latidorsatum (Michelin).
Cleoniceras daviesi sp. nov.
Cleoniceras cf. *daviesi*, sp. nov. (pl. VIII, fig. 17).
Cleoniceras sp. nov ? ind.
Douvilleiceras mammillatum (Schlotheim).
Hysteroceras sp. ind.
Brancoceras indicum sp. nov.
Brancoceras sp. nov.
Hamites cf. *attenuatus*, J. Sowerby.
Torneutoceras sp. ind.
Protanisoceras sp. ind.

The *Hypacanthoplites* ? fragment already referred to is not here listed since it is altogether doubtful. It may be only a portion of a very large but crushed *Douvilleiceras* although the last parahoplitids still occur at the top of the Lower Albian (*tardefurcata* zone) with early *Douvilleiceras*. Sommermeier [1] has recorded a fragment of a *Pseudosonneratia* of the *steinmanni* group from Peru, together with *Douvilleiceras mammillatum* ; and *Arcthoplites*[2] also occurs in beds of approximately similar (lowest Middle Albian) age, but small fragments of specimens belonging to these genera could not be satisfactorily distinguished. The Giumal sandstone form figured by Spitz[3] as *Hoplites* (*Parahoplites*) sp. may be a Lower Albian acanthoplitid, as he claims, but it is associated with a fragment, possibly of an Aptian *Dufrenoyia*, which certainly shows no resemblance to the Upper Albian *Stoliczkaia dispar*.

Of the twelve forms recorded, eleven in any case, belong to the Lower Gault or Middle Albian and only one is possibly of Upper Albian age, although in Peru [4] as well as at Folkestone similar *Hysteroceras* of the *orbignyi* type occur together with *Dipoloceras bouchardianum* already in the upper part of the Lower Gault.

On comparing the Samana fauna with that of Hazara we are struck at once by the absence, in the former, of examples of *Lyelliceras*. Among 550 Hazara fossils sent to the writer (Middlemiss collection) there are 250 specimens of *Lyelliceras* (=*Ammonites lyelli*, d'Orbigny and allies) as against 94 examples of *Douvilleiceras* which, according to Col. Davies, is the dominant ammonite genus in the Samana range. In England the two genera are certainly successive and not contemporaneous, *Douvilleiceras* being the earlier (*regularis* to *inæqui-*

[1] 'Fauna des Aptien und Albien im nördlichen Peru'. In Steinmann 'Beitr. z. Geol. und. Pal. v. Südamerika'. *N. Jb. f. Min. etc.*, Beil. Bd. XXX, 1910, p. 314.

[2] See Nikitin : 'Vestiges Per. Crét. Russie Centrale.' *Mém. Com. Géol. St. Pétersbourg*, vol. V (1888), p. 57, pl. iv, figs. 1—2.

[3] *Loc. cit.* (1914), pl. XVIII, fig. 1.

[4] Schlagintweit : 'Fauna des Vracon und Cenoman in Peru.' in Steinmann, *loc. cit.*, vol. XXXIII, 1911, p. 49.

nodum zones). The various Hazara localities[1] have yielded assemblages of Albian cephalopods of different horizons that are interesting enough to be listed :—

(*a*) Jabri (Jabriyan), Haro river (408 specimens).

Eutrephoceras (*Cymatoceras* ?) sp. ind.
Desmoceras latidorsatum (Michelin) (Pl. VIII, fig. 3).
Puzosia sp. ind. (Pl. VIII, fig. 2).
Cleoniceras sp. juv. ind.
Hypacanthoplites ? sp.
Douvilleiceras mammillatum (Schlotheim).
Douvilleiceras aff. *monile* (J. Sowerby) (Pl. IX, fig. 2).
Douvilleiceras spp. ind.
Lyelliceras lyelli (d'Orbigny) (Pl. IX, fig. 7).
„ aff. *lyelli* (d'Orbigny) (Pl. IX, figs. 9 and 11).
„ *pseudolyelli* (Parona and Bonarelli).
„ *cotteri* sp. nov. (Pl. IX, figs. 1 and 8).
„ spp. ind.
Raulíniceras (?) *versicostatum* (Michelin).
Brancoceras sp. ind.
Mojsisovicsia aff. delaruei (d'Orbigny) (Pl. IX, figs. 13 and 16).
„ *cf. ventanillensis* (Gabb) (Pl. IX, fig. 20).
Oxytropidoceras roissyanum (d'Orbigny) (Pl. IX, fig. 12).
„ *multifidum* (Steinmann) (Pl. IX, fig. 17).
„ aff. *mirapelianum* (d'Orb.) (Pl. IX, fig. 18).
„ *sergipense* (White) (Pl. IX, fig. 4).
„ aff. *chihuahuense* (Böse) (Pl. IX, fig. 23).
„ spp. ind.
Dipoloceras cf. *subinflatum* (Pictet) (Pl. IX, fig. 21).
„ aff. *bouchardianum* (d'Orbigny) (Pl. IX, fig. 22).
„ aff. *quadratum*, Spath.
Turrilitoides sp. ind. (*hugardianus* group).
Hamites cf. *attenuatus* (J. Sowerby) (Pl. VIII, fig. 19).
„ (?) sp. ind. (Pl. IX, fig. 6).
Torneutoceras spp. ind. (Pl. IX, fig. 14).
Metahamites aff. *elegans* (d'Orbigny) (Pl. IX, fig. 5).
„ *flexuosus* (d'Orbigny).
„ aff. *sablieri* (d'Orbigny) (Pl. VIII, fig. 15).
„ sp. nov. (Pl. IX, fig. 15).
Gen. nov. (*Astiericeras* ?) sp. nov. (Pl. VIII, fig. 13).

(*b*) Ridge south-east of Wijjiyan (33 specimens).

Eutrephoceras (*Cymatoceras* ?) spp. ind.
Gen. nov. ? (Cicatritid) sp. ind.

[1] The only ammonite from one of these ('Murree-Abbottabad Road, 16 miles from Murree, Hazara') belongs to the Spiti Shale genus *Octagoniceras* (=group of *Amm. octogonus*, Strachey MS., Blanford) and must have come from beds below the Albian 'band', but above the rock that yielded the Tithonian *Virgatosphinctes frequens* recorded by H. C. Das Gupta :—Pal. notes from Hazara. *Journ. and Proceed. As. Soc. Bengal*, vol. XI, No. 9 (1916), p. 256.

Puzosia sp. ind.
Brancoceras sp. ind.
Oxytropidoceras cf. *mirapelianum* (d'Orbigny).
Dipoloceras aff. *subcristatum* (Deluc) (Pl. IX, fig. 3).
,, sp. nov.
Prohysteroceras sp. nov. (2 fragments).
Hamites cf. *maximus* (J. Sowerby).
,, sp. ind.
Torneutoceras (?) spp. ind. (Pl. IX, figs. 10, 19).
Metahamites sp. ind.
Gen. nov. (Algeritidæ ?) spp. ind.
Belemnites spp. (indeterminable).

This fauna is very peculiar, containing about three or four undescribed species of an entirely new genus (probably of algeritids), to be worked out later, in addition to various other unusual elements. Middlemiss [1] stated that the glauconitic (conglomeratic) limestone at Wijjiyan was grey, not of the customary orange colour, and he mentioned that Waagen and Wynne considered the belemnites of 'rather extraordinary size for their geological age'. Those in the blocks sent to the writer are certainly larger than the European Gault belemnites, even the Lower Albian *Neohibolites strombecki* (Müller) or *N. minor* (Stolley).

(*c*) Dhamtaur, Hazara (1 specimen).
Pervinquieria sp. ind.

(*d*) Above Sataurah, Haro river (42 specimens).
Douvilleiceras aff. *mammillatum* (Schlotheim).
Astiericeras? sp. ind.
Lyelliceras lyelli (d'Orbigny).
,, *pseudolyelli* (Parona and Bonarelli).
,, spp. ind.
Brancoceras sp. nov. ?
,, sp. ind.
Raulíniceras (?) *versicostatum* (Michelin).
Mojsisovicsia sp. ind.
Oxytropidoceras sp. ind.

(*e*) Base of Sirban hill, below Nagakki (12 specimens).
Douvilleiceras mammillatum (Schlotheim).
,, *monile* (J. Sowerby).
Pervinquieria ? sp. ind. (1 fragment).
Prohysteroceras sp. juv. (1 fragment).
Hamites ? spp. ind.
Hamitoides ? sp. ind.

(*f*) South of Balkot, Haro river (39 specimens).
Douvilleiceras mammillatum (Schlotheim).
Douvilleiceras spp.

[1] 'Geology of Hazara and the Black Mountain'. *Mem., Geol. Surv. Ind.*, vol. XXVI, 1896, p. 35.

Lyelliceras lyelli (d'Orbigny).
,, spp. ind.
Raulíniceras (?) *versicostatum* (Michelin).
Oxytropidoceras multifidum (Steinmann).
,, *mirapelianum* (d'Orbigny).
Idiohamites ? sp. ind.
Gen. nov. (*Astiericeras* ?) sp. nov.

(*g*) Between Sataurah and Jabla, Haro river (15 specimens).
Douvilleiceras aff. *mammillatum* (Schlotheim).
Lyelliceras lyelli (d'Orbigny).
,, sp.
Raulíniceras (?) *versicostatum* (Michelin).
Mojsisovicsia aff. *ventanillensis* (Gabb).
Oxytropidoceras aff. *mirapelianum* (d'Orbigny).

It will be noticed at once that there are very few Upper Albian species and certainly nothing that indicates the fauna of the writer's *substuderi* and *dispar* zones (=Pleurohoplitan age ='Vraconnian'), not to mention the Cenomanian. It seems that Middlemiss's '*Ammonites mantelli*' was based on the numerous examples of *Lyelliceras*, certainly the dominant ammonite, and his *Amm. blanfordianus*, Stoliczka is the form here figured as *Lyelliceras cotteri*, sp. nov. (pl. IX, figs. 1 and 8), named after the palæontologist who first recognised their earlier (Albian) age. The 'certain' Cenomanian of Waziristan of Koken [1] is thus as spurious as that of the Salt Range and it has already been mentioned that Spitz's *Stoliczkaia* cf. *dispar* from the Himalayan Giumal sandstone is based on an erroneous identification. On the other hand, Mr. L. Rama Rau [2] has recently claimed the basal beds of the ammonitiferous Utatur series as of an age 'approximately corresponding to the Middle Albian of Europe'. The various elements of the lowest assemblages of Utatur, Odium, Maravattur, etc., can now be dated much more accurately than in 1922 [3] when I spoke of the Indian fauna as of late Albian age; but I can as yet see nothing that would indicate the existence in Southern India, of even the lower part of the Upper Albian. The almost universal *Hysteroceras* is a particularly notable absentee, and the no less world-wide *Pervinquieria* have a later aspect than the East African forms described by the writer,[4] as characteristic of the middle part of the Upper Gault, or the *varicosum* to *æquatoriale* zones. Dr. Whitehouse's Tambo series of the Rolling Down beds of Queensland which also contains the very curious criocones (*Labeceras* and *Myloceras*) found in Portuguese East Africa was similarly referred to the lower part of the Upper Albian (upper *orbignyi* and *varicosum* zones).[5]

[1] *Loc. cit.* (1903), p. 439.

[2] 'On the Age of the Utatur Marine Transgression'. *Journ. & Proceed. Asiatic Society Bengal*, N. S., vol. XIX (1923), No. 4 (1924), p. 87.

[3] 'Cretaceous Ammonoidea from Angola, etc.' *Roy. Soc. Edinburgh*, vol. LIII, pt. 1, No. 6, 1922, pp. 155—156.

[4] *Loc. cit* (1925, Ann. Transv. Mus.), pp. 183&ff.; *loc. cit.* (1921, Ann. South Afr. Mus.), pp. 284 &ff. (under the names of '*Inflaticeras*' and '*Subschloenbachia*').

[5] *Loc. cit* (1926), p. 197.

If we neglect such long-lived forms as *Desmoceras latidorsatum* or certain indefinite hamitids, the faunas listed above under (*a*), (*d*), (*f*), (*g*), consist entirely of Middle Albian elements.

Pending a detailed examination of the Albian sequence in Texas, however, the range of *Oxytropidoceras* is somewhat uncertain. In England *O. roissyanum* (d'Orbigny) was said to have been found[1] in bed I (*dentatus* zone); but the specimen is lost and the writer has not yet succeeded in discovering an example of this genus. At the Perte-du-Rhône it occurs with *Douvilleiceras mammillatum* and its contemporaries. *Mojsisovicsia* is restricted to a narrow horizon (bed 4) at Folkestone but may well have been earlier in more southern regions. *Dipoloceras*, on the other hand, in England is characteristic of the upper part of the Middle Albian. In Mexico Böse's beds 2 and 3[2] probably belonging to the middle and upper parts of the Middle Albian, have yielded various forms of *Oxytropidoceras* comparable to species here listed.

The assemblages (*b*) and (*e*) each comprise, in addition to a great majority of Middle Albian forms, two fragments of Upper Albian ammonite genera (*Prohysteroceras*, *Pervinquieria*), and the seventh locality (*c*) has yielded only a single example which, however, is of undoubted Upper Albian age. Unfortunately it is too poorly preserved for specific identification; it may be comparable to the Utatur form *Pervinquieria æquatorialis* (Kossmat),[3] but less similar species occur already in the lower part of the Upper Albian, *e.g.*, forms of the *prerostrata* type, previously referred to.[4] In any case there can be no question of correlating this '*inflatus* horizon' with the Bagh beds of Gwalior and the Narbada Valley. These beds were originally assigned by Vredenburg[5] to the Cenomanian, while R. Fourteau[6] from a study of the echinoids referred them to the Albian. Nevertheless the ammonite fauna is Turonian and undoubtedly later than Cenomanian.

It appears, thus, that the Gault faunas of Samana and Hazara are on the whole of Middle Albian age and include only a few forms of the Upper Albian (possibly local remnants of denuded beds), whilst the Utatur series of Southern India comprises only the top of the Albian (so-called 'Vraconnian'), succeeded by Upper Cretaceous beds. That is to say the 'widely recognised Cenomanian transgression' was as local as were previous and later transgressive movements, and in north-western India, the unconformity at the top of what Albian beds remain indicates a considerable break in the succession corresponding probably to a period of emergence rather than to a mere change in the submarine erosion level. Prof. J. W. Gregory[7] has already shown in connection with the Albian

[1] 'Price': The Gault (1879, p. 74).

[2] 'Monogr. Geol. y Pal. del Cerro de Muleros'. *Bol. Inst. Geol. Mexico*, No. 25, 1910, pp. 20—21.

[3] Non *Amm. æquatorialis*, *v. Buch*, Berlin Monatsb. 1838, p. 64; Amer. p. 15, pl. i, figs. 11—12, also included in "*Cristati*", but referred by R. Douvillé to Gerhardt's genus *Pedioceras*.

[4] *Loc. cit.* (1921, Ann. South. Afr. Mus.), p. 285.

[5] 'The Ammonites of the Bagh beds'. *Rec. Geol. Surv. Ind.*, vol. XXXVI (1907), pp. 109—125 and 239—240.

[6] 'Les Echinedes des Bagh beds'. *Rec. Geol. Surv. Ind.*, vol. XLIV (1913), pp. 34—53.

[7] "Supplementary Note on the Geology of Benguella, etc." *Trans. Roy. Soc. Edinb.*, Vol. LIII, pt. 1, No. 7, 1922, p. 163.

deposits of Angola that the Cenomanian transgression was far less regular than had been supposed, and the Gault is no more 'an age of transition' than is the Cenomanian above or the Aptian below.

It is interesting to note that the Albian ammonite faunas of Hazara and Samana do not include a single pseudoceratite. I was previously [1] inclined to attribute the difference between the Angola assemblage and the peculiar Mediterranean facies (with *Knemiceras uhligi*) to difference in age of the deposits; but *Engonoceras* has now been found in England in the upper part of the Middle Albian ('*cornutum* zone') as well as in the *dispar* zone,[2] although hoplitids are here the dominant ammonites. Again in *e.g.*, Mexico, in the beds with *Oxytropidoceras chihuahuense* and allied forms here figured, there occur species of *Engonoceras*, whilst even the European *Parengonoceras ebrayi* (de Loriol) is associated with *Douvilleiceras mammillatum*.

The very fine collection of pseudoceratites from Persia, already referred to [3] includes an isolated example of *Lyelliceras* close to *L. cotteri* [4] here described, but with irregular siphonal tubercles, as in *L. pseudolyelli* (Parona and Bonarelli). There can be no doubt about its early Middle Albian age, but Douvillé [5] had previously only recorded a doubtful '*Sonneratia*', compared to the forms of the group of *Amm. versicostatus*, that could have come from beds between those with undoubted Aptian and Cenomanian ammonites. The *Knemiceras* now before me are of the type of the Peruvian forms described by R. Douvillé [6] and Sommermeier [7] which are associated with Lower and Middle Albian *Lyelliceras*, *Prolyelliceras* (gen. nov.),[8] *Douvilleiceras*, *Oxytropidoceras*, *Venezoliceras*, etc., on the one hand and Lower Albian or Upper Aptian parahoplitids on the other. The absence of *Pseudoceratites* may be due to difference of facies during the Middle Albian, but it seems that the Lower Albian during which the Persian and Peruvian (perhaps also the Syrian) *Knemiceras* flourished, is not represented by ammonitiferous beds in India. At Samana, as Col. Davies has shown, over 700 feet of unfossiliferous sandstones underlie and gradually pass up into the compound glauconitic bed with the Albian ammonoids here described and it is possible that they represent only the Lower Albian. They rest unconformably on another

[1] *Loc. cit.* (Angola, 1922), p. 156.

[2] Spath: "On a new Ammonite (*Engonoceras iris* sp. nov.) from the Gault of Folkestone". *Ann. Mag. Nat. Hist.*, ser. 9, Vol. XIV, 1924, p. 504; "On the Zones of the Cenomanian and the Uppermost Albian". *Proc. Geol. Assoc.*, vol. XXXVII (1926), p. 422.

[3] Spath: 'Notes on Yorkshire Ammonites.—X. On some Post-Liassic Ammonites and a new species of *Bonarellia*'. *Naturalist*, 1926, p. 326.

[4] Karsten's *Amm. barbacoensis* (Géologie de l'ancienne Colombie Bolivarienne, etc. Berlin, 1886, pl. iv, figs. 5*a*, *b*). has a periphery similar to that of *L. cotteri*, but is more involute.

[5] *Loc. cit.* (1904), p. 233.

[6] 'Sur des Ammonites du Crétacé Sud-Américain': Ann. Soc. Roy. zool. et. malacol. de Belgique, vol. XLI (1906), 1907, p. 142.

[7] *Loc. cit.* (1910), pp. 336—369, pls. IX—XIV.

[8] Proposed for *Prolyelliceras peruvianum*, nom. nov.=*prorsocurvatum* (non Gerhardt) R. Douvillé, *loc. cit.*, 1907, p. 144, pl. ii, figs. 1, 1*a*. To this genus also belong Sommermeier's (*loc. cit.*, p. 380, pl. xv, fig. 3) *Prionotropis radenaci* (non Pervinquière) and less certainly the Tunisian species previously discussed (Spath, 1922, Angola, p. 108). *Prolyelliceras* without lateral tubercles, connects *Lyelliceras* morphologically with the parahoplitids (*Colombiceras*), but may be an independent Puzosid offshoot.

glauconitic bed with belemnites that probably corresponds to the similar bed at Thal that yielded the Valanginian-Hauterivian *Olcostephanus*, above described, and there seems to be a complete absence of the Upper Neocomian (Hauterivian and Barremian), and no sign of the Lower Aptian transgression which certainly reached Persia and Kachh (Cutch).[1]

[1] Not referred to in Dr. Cotter's note (*loc. cit.*, 1927, p. 409).

PLATE VIII.

Fig. 1*a*, *b*. OLCOSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. Side and peripheral views. Neocomian (basal Hauterivian). Belemnite bed, Kadimak mtn., north of Thal. (p. 58). G. S. I. No. 14,502.

Fig. 2. PUZOSIA sp. ind. (possibly a compressed variety of *P. quenstedti*, Parona and Bonarelli). With five constrictions. Albian, Jabriyan, Hazara. (p. 61). G. S. I. No. 14,505.

Fig. 3. DESMOCERAS LATIDORSATUM (Michelin). Albian, Jabriyan, Hazara. (p. 53). G. S. I. No. 14,485.

Fig. 4. OLCOSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. Neocomian (basal Hauterivian). Chichali hills, West of Kalabagh, Salt Range. (p. 58). B. M. No. C 93*a*.

Fig. 5. OLCOSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. Side-view of a less globose and less involute variety. Same horizon and locality. (p. 58). B. M. No. C 93*b*.

Fig. 6*a*, *b*. HYSTEROCERAS sp. ind. Fragment with restored outline and whorl-section. Albian, Samana. (p. 55). G. S. I. No. 14,491.

Fig. 7*a*, *b*. CLEONICERAS sp. juv. ind. Lateral view of fragment with outline whorl-section. Albian, Samana. (p. 54). G. S. I. No. 14,503.

Fig. 8*a*, *b*. CLEONICERAS sp. juv. ind. Fragment of another species (?) with outline whorl section. Albian, Samana. (p. 54). G. S. I. No. 14,504.

Fig. 9*a*, *b*. BRANCOCERAS INDICUM sp. nov. Side-view and outline whorl-section. Albian, Samana. (p. 55.) G. S. I. No. 14,493.

Fig. 10*a*, *b*. TORNEUTOCERAS sp. ind. Fragment, with sectional outline. Albian, Samana. (p. 57). G. S. I. No. 14,496.

Fig. 11*a*, *b*. CLEONICERAS sp. nov. ? ind. Side-view and outline whorl-section. Albian, Samana. (p. 54). G. S. I. No. 14,485.

Fig. 12. DOUVILLEICERAS MAMMILLATUM (Schlotheim). Peripheral view of a typical fragment. Albian, Samana. (p. 54). G. S. I. No. 14,487.

Fig. 13*a*, *b*. Gen. nov. (*Astiericeras* ?) sp. ind. Side and ventral views of a doubtful fragment. It differs from the specimen listed under (*d*) (p. 62) in having ventral as well as dorsal ribs starting in pairs from the lateral tubercle. Albian, Jabriyan, Hazara. (p. 61). G. S. I. No. 14,506.

Fig. 14*a*, *b*, *c*. PROTANISOCERAS sp. ind. Side and ventral views and sectional outline. Albian, Samana. (p. 58). G. S. I. No. 14,501.

Fig. 15. METAHAMITES aff. SABLIERI (d'Orbigny). Side-view of a fragment. Albian, Jabriyan, Hazara. (p. 61). G. S. I. No. 14,507.

Fig. 16. DOUVILLEICERAS MAMMILLATUM (Schlotheim). Side-view of an immature example with protracted '*clavatus*' stage. Albian, Samana. (p. 54). G. S. I. No. 14,488.

Fig. 17*a*, *c*. CLEONICERAS DAVIESI, sp. nov. Side and peripheral views and outline whorl-section of holotype. Albian, Samana. (p. 53). G. S. I. No. 14,484.

Fig. 18*a*, *b*. BRANCOCERAS sp. nov. Side-view and outline whorl-section. Albian, Samana. (p. 56). G. S. I. No. 14,494.

Fig. 19. HAMITES cf. ATTENUATUS, J. Sowerby. Side-view of a small fragment. Albian, Jabriyan, Hazara. (p. 57). G. S. I. No. 14,495.

PLATE VIII.

LCOSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. Side and peripheral views. Neocomian (basal Hauterivian). Belemnite bed, Kadimak mtn., north of Thal. (p. 53). G. S. I. No. 14,502.

OSIA sp. ind. (possibly a compressed variety of *P. quenstedti*, Parona and Bonarelli). With five constrictions. Albian, Jabriyan, Hazara. (p. 61). G. S. I. No. 14,505.

SMOCERAS LATIDORSATUM (Michelin). Albian, Jabriyan, Hazara. (p. 53). G. S. I. No. 14,483.

.COSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. Neocomian (basal Hauterivian). Chichali hills, West of Kalabagh, Salt Range. (p. 58). B. M. No. C 93*a*.

LCOSTEPHANUS aff. ASTIERIANUS (d'Orbigny) auct. Side-view of a less globose and less involute variety. Same horizon and locality. (p. 58). B. M. No. C 93*b*.

. HYSTEROCERAS sp. ind. Fragment, with restored outline and whorl-section. Albian, Samana. (p. 55). G. S. I. No. 14,491.

). CLEONICERAS sp. juv. ind. Lateral view of fragment with outline whorl-section. Albian, Samana. (p. 54). G. S. I. No. 14,503.

b. CLEONICERAS sp. juv. ind. Fragment of another species (?) with outline whorl section. Albian, Samana. (p. 54). G. S. I. No. 14,504.

b. BRANCOCERAS INDICUM sp. nov. Side-view and outline whorl-section. Albian, Samana. (p. 55.) G. S. I. No. 14,493.

, *b*. TORNEUTOCERAS sp. ind. Fragment, with sectional outline. Albian, Samana. (p. 57). G. S. I. No. 14,496.

b. CLEONICERAS sp. nov. ? ind. Side-view and outline whorl-section. Albian, Samana. (p. 54). G. S. I. No. 14,485.

. DOUVILLEICERAS MAMMILLATUM (Schlotheim). Peripheral view of a typical fragment. Albian, Samana. (p. 54). G. S. I. No. 14,487.

3*a*, *b*. Gen. nov. (*Astiericeras* ?) sp. ind. Side and ventral views of a doubtful fragment. It differs from the specimen listed under (*d*) (p. 62) in having ventral as well as dorsal ribs starting in pairs from the lateral tubercle. Albian, Jabriyan, Hazara. (p. 61). G. S. I. No. 14,506.

14*a*, *b*, *c*. PROTANISOCERAS sp. ind. Side and ventral views and sectional outline. Albian, Samana. (p. 58). G. S. I. No. 14,501.

15. METAHAMITES aff. SABLIERI (d'Orbigny). Side-view of a fragment. Albian, Jabriyan, Hazara. (p. 61). G. S. I. No. 14,507.

. 16. DOUVILLEICERAS MAMMILLATUM (Schlotheim). Side-view of an immature example with protracted '*clavatus*' stage. Albian, Samana. (p. 54). G. S. I. No. 14,488.

. 17*a*, *c*. CLEONICERAS DAVIESI, sp. nov. Side and peripheral views and outline whorl-section of holotype. Albian, Samana. (p. 53). G. S. I. No. 14,484.

. 18*a*, *b*. BRANCOCERAS sp. nov. Side-view and outline whorl-section. Albian, Samana. (p. 56). G. S. I. No. 14,494.

.19. HAMITES cf. ATTENUATUS, J. Sowerby. Side-view of a small fragment. Albian, Jabriyan, Hazara. (p. 57). G. S. I. No. 14,495.

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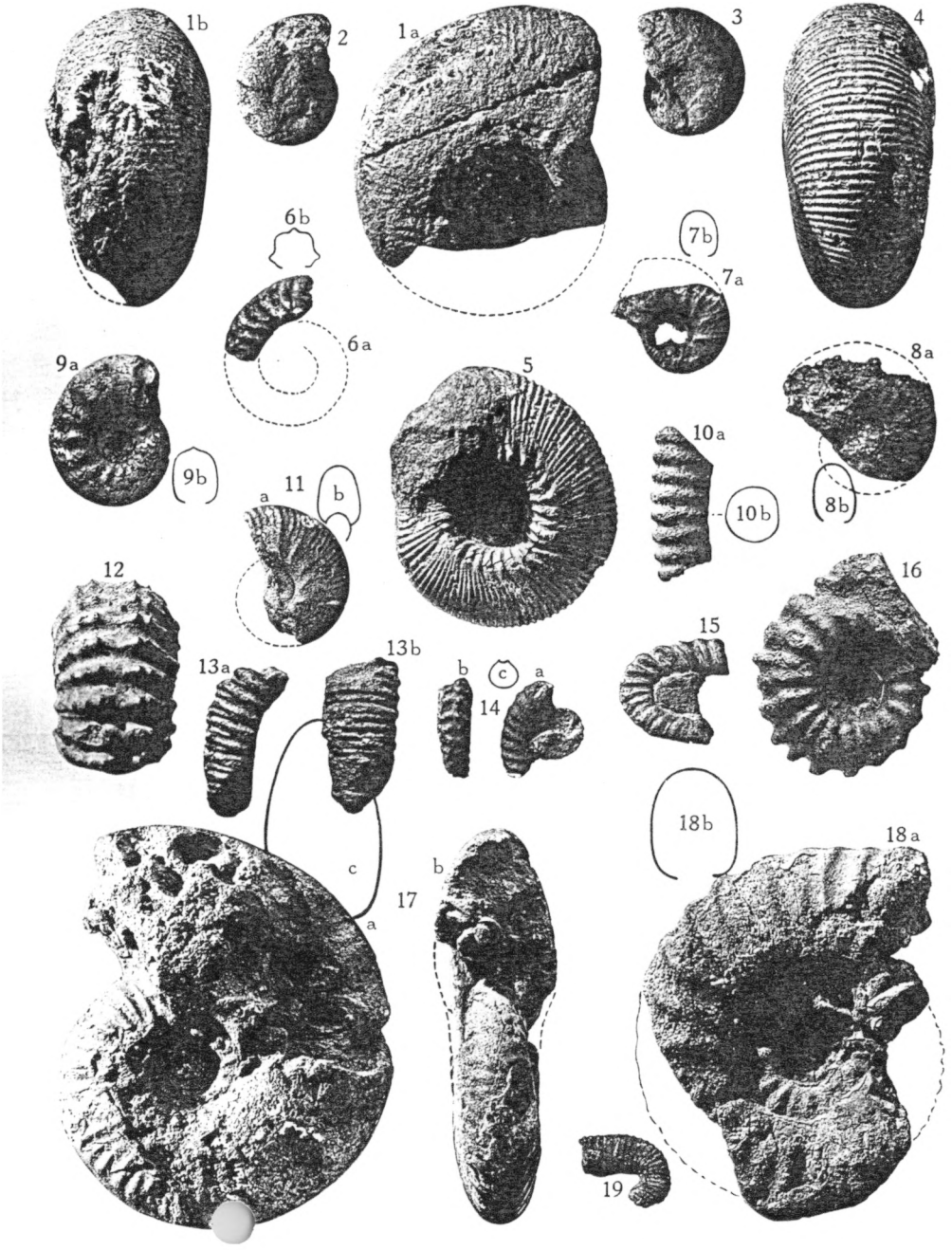

PLATE IX.

LYELLICERAS COTTERI, sp. nov. Holotype. (The regularly trituberculate peripheral ribs are more prominent than those of *L. lyelli* [fig. 7] and the whorl-thickness is only 30 per cent of the diameter.) Middle Albian of Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,508.)

DOUVILLEICERAS aff. MONILE (J. Sowerby). Side-view of a fragmentary specimen from the lower Middle Albian of Jabriyan, Hazara. (p. 55). (G. S. I. No. 14,516.)

HYPOLOCERAS aff. SUBCRISTATUM (Deluc). Peripheral view of a fragment from the Albian, 'Ridge south-east of Wijjiyan', Hazara. (p. 62). (G. S. I. No. 14,517.)

?. OXYTROPIDOCERAS SERGIPENSE (White). Lateral and peripheral views of a fragment. Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,520).

ETAHAMITES aff. ELEGANS (d'Orbigny). Side-view of a poorly preserved fragment. Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,512.)

AMITES (?) sp. ind. Side-view of one of a number of doubtful fragments. Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,514.)

ELLICERAS LYELLI (d'Orbigny). Peripheral view of a typical example from the Middle Albian of Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,510.)

ELLICERAS COTTERI sp. nov. Side-view of paratype with slightly coarser ornamentation and less compressed whorl-section. The inner whorls at first resemble those of *Raulinieeras* ? *versicostatum* (Michelin). Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,509.)

ELLICERAS aff. LYELLI (d'Orbigny). Peripheral view of an example with more prominent ventral tubercles than the type. Middle Albian of Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,511.)

NEUTOCERAS (?) sp. ind. Fragment from the [Upper ?] Middle Albian of 'Ridge, south-east of Wijjiyan', Hazara. (p. 62). (G. S. I. No. 14,499.)

ELLICERAS aff. LYELLI (d'Orbigny). Side-view of an evolute form, differing from the similar *L. pseudolyelli* (Parona and Bonarelli) in its regular peripheral tuberculation. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,515.)

YTROPIDOCERAS aff. ROISSYANUM (d'Orbigny). Side-view of one of numerous fragments. Middle Albian, Jabriyan, Hazara. (p. 56). (G. S. I. No. 14,521).

SISOVICSIA sp. juv. aff. DELARUEI (d'Orbigny). Side-view of an immature example. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,525.)

NEUTOCERAS sp. ind. Ventral view of a slightly crushed fragment. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,498.)

AHAMITES sp. nov. Side-view of the new form referred to on p. 57. Poorly preserved, but apparently with sulcate periphery. Middle Albian, Jabriyan, Hazara. (p. 57). (G. S. I. No. 14,513.)

SISOVICSIA sp. aff. DELARUEI (d'Orbigny). Side-view of another example with very prominent keel. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,526).

TROPIDOCERAS cf. MULTIFIDUM (Steinmann). Side-view of a small fragment showing typical ribbing, Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,522.)

TROPIDOCERAS sp. juv. (ROISSYANUM—MIRAPELIANUM group). Side-view of an immature example. Same bed and locality. (p. 61). (G. S. I. No. 14,523.)

EUTOCERAS ? sp. ind. Side-view of a second doubtful fragment from the [Upper ?] Middle Albian of 'Ridge, south-east of Wijjiyan', Hazara. (p. 62). (G. S. I. No. 14,500.)

ISOVICSIA cf. VENTANILLENSIS (Gabb) Lisson sp. Side-view of one of numerous fragments. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,527).

LOCERAS cf. SUBINFLATUM (Pictet). Side-view of a fragment with square whorl-section, as in later *Pervinquieria* (*e.g.*, *P. pachys*, Seeley sp.). Same bed and locality. (p. 61). (G. S. I. No. 14,518.)

LOCERAS aff. BOUCHARDIANUM (d'Orbigny). Side-view of a typical fragment. Same bed and locality. (p. 61). (G. S. I. No. 14,519.)

OXYTROPIDOCERAS aff. CHIHUAHUENSE (Böse). Side and peripheral views of one of a number of fragments showing great resemblance to Böse's (loc. cit., 1910, pl. viii, figs. 1—2) form and the allied *O. belknapi* (Marcou) auct. Same bed and locality. (p. 61). (G. S. I. No. 14,524.)

PLATE IX.

Fig. 1. LYELLICERAS COTTERI, sp. nov. **Holotype.** (The regularly trituberculate peripheral ribs are more prominent than those of *L. lyelli* [fig. 7] and the whorl-thickness is only 30 per cent of the diameter.) Middle Albian of Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,508.)

Fig. 2. DOUVILLEICERAS aff. MONILE (J. Sowerby). Side-view of a fragmentary specimen from the lower Middle Albian of Jabriyan, Hazara. (p. 55). (G. S. I. No. 14,516.)

Fig. 3. DIPOLOCERAS aff. SUBCRISTATUM (Deluc). Peripheral view of a fragment from the Albian, 'Ridge south-east of Wijjiyan', Hazara. (p. 62). (G. S. I. No. 14,517.)

Figs. 4*a*, *b*. OXYTROPIDOCERAS SERGIPENSE (White). Lateral and peripheral views of a fragment. Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,520).

Fig. 5. METAHAMITES aff. ELEGANS (d'Orbigny). Side-view of a poorly preserved fragment. Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,512.)

Fig. 6. HAMITES (?) sp. ind. Side-view of one of a number of doubtful fragments. Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,514.)

Fig. 7. LYELLICERAS LYELLI (d'Orbigny). Peripheral view of a typical example from the Middle Albian of Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,510.)

Fig. 8. LYELLICERAS COTTERI sp. nov. Side-view of paratype with slightly coarser ornamentation and less compressed whorl-section. The inner whorls at first resemble those of *Raulinoceras ? versicostatum* (Michelin). Middle Albian, Jabriyan, Hazara (p. 61). (G. S. I. No. 14,509.)

Fig. 9. LYELLICERAS aff. LYELLI (d'Orbigny). Peripheral view of an example with more prominent ventral tubercles than the type. Middle Albian of Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,511.)

Fig. 10. TORNEUTOCERAS (?) sp. ind. Fragment from the [Upper ?] Middle Albian of 'Ridge, south-east of Wijjiyan', Hazara. (p. 62). (G. S. I. No. 14,499.)

Fig. 11. LYELLICERAS aff. LYELLI (d'Orbigny). Side-view of an evolute form, differing from the similar *L. pseudolyelli* (Parona and Bonarelli) in its regular peripheral tuberculation. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,515.)

Fig. 12. OXYTROPIDOCERAS aff. ROISSYANUM (d'Orbigny). Side-view of one of numerous fragments. Middle Albian, Jabriyan, Hazara. (p. 56). (G. S. I. No. 14,521).

Fig. 13. MOJSISOVICSIA sp. juv. aff. DELARUEI (d'Orbigny). Side-view of an immature example. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,525.)

Fig. 14. TORNEUTOCERAS sp. ind. Ventral view of a slightly crushed fragment. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,498.)

Fig. 15. METAHAMITES sp. nov. Side-view of the new form referred to on p. 57. Poorly preserved, but apparently with sulcate periphery. Middle Albian, Jabriyan, Hazara. (p. 57). (G. S. I. No. 14,513.)

Fig. 16. MOJSISOVICSIA sp. aff. DELARUEI (d'Orbigny). Side-view of another example with very prominent keel. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,526).

Fig. 17. OXYTROPIDOCERAS cf. MULTIFIDUM (Steinmann). Side-view of a small fragment showing typical ribbing, Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,522.)

Fig. 18. OXYTROPIDOCERAS sp. juv. (ROISSYANUM—MIRAPELIANUM group). Side-view of an immature example. Same bed and locality. (p. 61). (G. S. I. No. 14,523.)

Fig. 19. TORNEUTOCERAS ? sp. ind. Side-view of a second doubtful fragment from the [Upper ?] Middle Albian of 'Ridge, south-east of Wijjiyan', Hazara. (p. 62). (G. S. I. No. 14,500.)

Fig. 20. MOJSISOVICSIA cf. VENTANILLENSIS (Gabb) Lisson sp. Side-view of one of numerous fragments. Middle Albian, Jabriyan, Hazara. (p. 61). (G. S. I. No. 14,527).

Fig. 21. DIPOLOCERAS cf. SUBINFLATUM (Pictet). Side-view of a fragment with square whorl-section, as in later *Pervinquieria* (*e.g.*, *P. pachys*, Seeley sp.). Same bed and locality. (p. 61). (G. S. I. No. 14,518.)

Fig. 22. DIPOLOCERAS aff. BOUCHARDIANUM (d'Orbigny). Side-view of a typical fragment. Same bed and locality. (p. 61). (G. S. I. No. 14,519.)

Fig. 23*a*, *b*. OXYTROPIDOCERAS aff. CHIHUAHUENSE (Böse). Side and peripheral views of one of a number of fragments showing great resemblance to Böse's (loc. cit., 1910, pl. viii, figs. 1—2) form and the allied *O. bellinapi* (Marcou) auct. Same bed and locality. (p. 61). (G. S. I. No. 14,524.)

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