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LOWER CALLOVIAN AMMONITES
FROM WAM TANGI, NAKUS, BALUCHISTAN

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TABLE 1. Correlation of Jurassic and Lower Cretaceous rocks of Baluchistan and Kohat-Potwar Area.

PLATES. 1 and 2 with explanation.

ABSTRACT

Lower Callovian ammonites from Wam Tangi, Nakus area of Baluchistan are described. The ammonites belong to the *Macrocephalus* Zone of the Lower Callovian. The presence of the sub-genus *Bomburites* and genus *Paralcidia* is reported for the first time from Baluchistan. A pre Lower Callovian disconformity is also established in Wam Tangi which separates the Lower Callovian ammonite bed from the underlying Chiltan Limestone of doubtful—? Lower-Middle Jurassic age. The fauna compares favourably with other parts of Baluchistan (Mazar Drik), Cutch, parts of Africa and Europe. Tentative correlation of the Jurassic and Cretaceous rocks of West Pakistan is offered and the correlation problem of the various Jurassic formations known from Baluchistan is discussed.

INTRODUCTION

During the course of geological mapping of coal bearing area of Nakus and Harnai Mr. M. Y. Khan in 1967 located a fossiliferous (ammonite) bed near the contact of Chiltan limestone and "Belemnite" shale of contended Jurassic and Lower Cretaceous ages respectively. His collection of two ammonites was identified by the present author as *Choffatia* sp. and the beds were assigned a Callovian age. As rocks and ammonites of unquestioned Callovian age were not previously known from this area, the fossil locality was visited along with Mr. M. Y. Khan in September, 1968. This study is based on a small collection made from upstream of Wam Tangi nala (Survey of Pakistan topo sheet 38 N:16) about 6 to 7 miles north, north east of Nakus. The ammonites which are preserved as internal moulds (Preservation may be regarded as fair to poor) include a typical Lower Callovian assemblage belonging to the genera *Macrocephalites* (Sub-genera *Indocephalites*, *Dolikephalites*, *Pleurocephalites*), *Choffatia*, *Paralcidia*, *Kheraicerias* (*Bomburites*). The sub-genus *Bomburites* and the genus *Paralcidia* are reported for the first time from Pakistan.

The fossil locality (fig. 1) lies in a tributary stream that joins the Wam Tangi from the east and runs close to the contact of Chiltan limestone and "Belemnite" shale. It is approachable by a jeepable track from either Nakus or Harnai. The distance from Nakus is 6 to 7 miles and from Harnai 8 to 9 miles. Harnai and Nakus are connected by railway from Sibi or by road from Quetta.

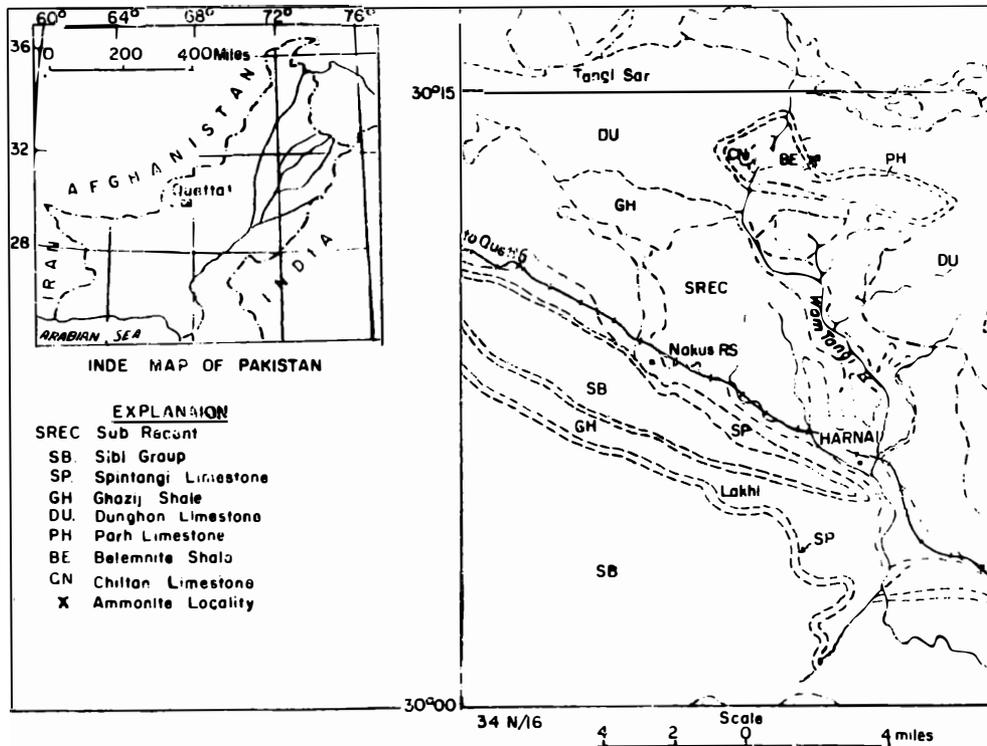


FIG. 1 INDEX MAP SHOWING LOWER CALLOVIAN AMMONITE LOCALITY
WAM TANGI, NAKUS AREA

PREVIOUS WORK

No ammonites of Jurassic age have been mentioned from this area. Hunting Survey Corporation of Canada (1960) who geologically mapped this territory on 1"=4 miles scale failed to establish any fossil evidence of the age of Chiltan limestone or the overlying "Belemnite" shale and provisionally assigned the former to the Middle and Upper Jurassic and the latter to the Lower Cretaceous. They further mapped the contact of the two as conformable and pointed out the similarity of the Chiltan limestone with the "Massive limestone" of Noetling (1897) and Vredenburg (1909) in Mazar Drik.

Dean Williams (1958) in the stratigraphical descriptions of the Lower Indus correlated his "Takatu limestone" (a massive, thick bedded formation) with the Chiltan limestone and considered it as Middle (Post Bajocian) or Upper Jurassic in age. According to him in the type locality of Sembar formation ("Belemnite" shale) the Takatu (=Chiltan limestone) follows the Sembar disconformably.

Noetling (1897) described *Macrocephalites* and *Choffatia* fauna from Mazar Drik in Mari hills which lies 70 to 80 miles to the south-east of the presently described locality of Wam Tangi. The ammonites also include some Upper Bathonian forms like *Clydoniceras* sp and *Bullatimorphites bullatus* (d'Orbigny) and according to Arkell (1956, p. 397) are presumably from the lower part of the sequence. The ammonites occur in a thin bedded limestone and shale sequence named by Arkell (1956) as Mazar Drik limestone and considered by Standard Vacuum Oil Company (J. R. Huth, Section No. 54, 1960) as a 50 feet thick unit. Apparently the "massive limestone" of Noetling and Vredenburg (= Chiltan limestone) underlies this thin bedded Mazar Drik limestone of Arkell (1956) or the "polyphemus" Beds of Vredenburg (1909).

Noetling's work was revised by Spath (1933) who pointed out that Noetling misidentified some *Macrocephalites* species and assigned them to Waagen's (1875) *polyphemus* species, which is an *Epimayaites* of Upper Oxfordian age (Spath 1933, p. 808). Thus *Macrocephalites "polyphemus"* (Waagen) was renamed by Spath as *Macrocephalites (Indocephalites) aff. gibbosus* Spath. The name "polyphemus" was unfortunately used latter by Vredenburg (1909) and by many other workers giving a wrong impression to the Lower Callovian fauna which Noetling described and meant.

Vredenburg (1909, p. 201) recognized a similar Lower Callovian fauna in the "polyphemus beds" of Morau anticline of Sarwan area of Baluchistan (referring them to the Callovian) and placed these rocks above his Bajocian—Bathonian "massive limestone". His "polyphemus beds" comprise of thin bedded limestone and shale and are similar to Mazar Drik which are referred by Arkell as Mazar Drik limestone. The name Mazar Drik formation is here adopted for the "polyphemus" limestone of Noetling and Vredenburg and is considered a recognisable unit above the Chiltan limestone (=Takatu limestone of Dean Williams or Massive limestone of Vredenburg).

STRATIGRAPHY

The general rock sequence (fig. 1) exposed in the Wam Tangi gorge consists of the following (Hunting Survey Corporation 1960, 1" = 4 miles map).

5 Ghazij shale	Eocene
4 Dunghan limestone	Paleocene
3 Parh limestone	Cretaceous
2 Belemnite shale	Lower Cretaceous
1 Chiltan limestone	Jurassic

Some oil company geologists have recognized another Cretaceous rock unit namely Moro formation below the Dunghan limestone and above Parh limestone.

The investigated ammonite bed occur above Chiltan Limestone (unit 1) and below the main Belemnite shale (unit 2) of Hunting Survey Corporation. The detailed stratigraphy is as follows.

C "Belemnite" shale consist of the following sub-divisions

- (iii) Dark grey shale, bedded with some calcareous nodules, and belemnites (*Hibolites* sp.)
- (ii) Black to dark grey sandy silty pyritic shale unfossiliferous 10—15 feet
- (i) Highly pyritic nodular argillaceous bed. 6" to 1 foot.

NON SEQUENCE

B. Mazar Drik formation

(ii) Highly pyritic siltstone 2-3 feet

(i) Grey, brownish grey pyritic argillaceous limestone, fossiliferous (Lower Callovian ammonites, bivalves, *Belemnopsis* sp.) with a 6" to very thin ferruginous reddish brown clay towards the base. Thickness 1 to 3 feet approximately.

DISCONFORMITY

A. Chiltan limestone, grey, medium grey, thick bedded limestone, colitic, fine to coarse texture in beds with some communitied shells and having an uneven top surface.

The Chiltan limestone forms the core of the Wam Tangi anticline, and rimming this limestone on the south flank is exposed the ammonite bed which follows the Chiltan limestone with a marked disconformity which is indicated by the ferruginous clay at the base of the ammonite bed and by the uneven lateritic top surface of the Chiltan limestone. The ammonite bed passes into the overlying unfossiliferous pyritic siltstone which has a gradational contact and the whole unit B has a total thickness of approximately 5 feet. The overlying basal beds of the "Belemnite" shale are highly pyritic nodular unfossiliferous and are suggestive of a significant non sequence representing likely the time span extending from Middle Callovian to early Upper Jurassic (Pre Tithonian ?)

AGE AND CORRELATION

The ammonites identified from the argillaceous pyritic limestone (unit 5 B (i)) of the above sequence may be listed as follows.

1. *Macrocephalites (Inecephalites) cf. diadematus* (Waagen).
2. *M. (Dolikephalites) cf. perlamellosus* Spath.
3. *M. (Pleurocephalites) sp. indet.*
4. *Choffatia (Choffatia) aff. soorkoensis* (Spath.)
5. *Choffatia (? Homoeoplanulites) sp. indet.*
6. *Kheraicerias (Bomburites) nakusiensis sp. nov.*
7. *Paralcidia dubia* (Spath).

The assemblage indicate a Lower Callovian Age (Macrocephalus Zone). The genera *K. (Bomburites)* and *Paralcidia* are recognized for the first time from Baluchistan. The presence of the subgenus *Homoeoplanulites* of the genus *Choffatia* is also suspected as the species is small in size and does not show modification of ribs normally seen in the subgenus *Choffatia*.

The age of the underlying Chiltan limestone is considered here pre Lower Callovian and may be regarded as lower-Middle Jurassic (Table-1). The age of the overlying Sembar Formation ("Belemnite" shale) may extend from Tithonian to Neocomian with a non sequence at the base extending from Middle Callovian to Pre Tithonian. As no direct evidences of the ages of the Chiltan limestone and Sembar formation are yet available, the age assignment is thus tentative.

(a) *Correlation with Mazar Drik and Sarwan areas of Baluchistan.*—The Wam Tangi ammonite fauna resembles strongly the *Macrocephalites* and *Choffatia* fauna described by Noetling (1897) from Mazari Drik, Baluchistan. Arkell (1956), reviewing the fauna, places it in the Macrocephalus Zone, and considers it to have come presumably from the upper part of Mazar Drik formation. In Mazar Drik, however, no *Bomburites* and *Paralcidia* are reported, but Upper Bathonian forms like *Clydonicerias* and *Bullatimorphites bullatus* (d'Orbigny) are figured which according to Arkell seems to have come from the lower part of Mazar Drik formation. A similar *Macrocephalites* fauna is reported by Vredenburg (1909) from his "polyphemus" limestone (thin bedded limestone and shale equivalent to Mazar Drik limestone) in the Sarwan area and assigned to the Callovian (Table—1). In both these areas of Mazar Drik and Sarwan the Mazar Drik thin bedded limestone and shale are underlain by Chiltan limestone (massive limestone of Neotling and Vredenburg). The relationship of these two formations is not clearly known. But it seems that they follow each other without any discordance.

		Arkell, Wright and Kummel (1937)	Mazer Drik after Hoelling (1937) Arkell (1938) Sighees	Sarwan & Jalowar Wrodenburg (1909) Arsal (1936)	Lower Indus Beds Williams M.D (1933)	Hustaf Survey Corp 1930 (Quetta region)	Trans Indus Salt Range Fehm (1933)	Kalechitto Fehm (1933)	Western Kohat (Samana Range) Fehm (1933)	WanTang, Moha Fehm (1933)	
CRETACEOUS	Lower Cretaceous	Athien	Garu formation ?	"Lithole" Beds Park limestone ?	Garu formation	Lower part of Park series	Lumabul Formation ?	Lumabul Formation	Lumabul Formation ?	Lower part of Park limestone ?	
		Aplicn	Sember formation	Solemnite shale	Sember formation (base doubtfully considered extending into upper Jurassic)	Solemnite shale of base.	Chichell Formation	Chichell Formation	Chichell Formation	Sember formation	
		Barrémian									
		Hauterlivian									
		Valanginian									
		Berriestian	Tithonian	Kimmeridgian	Uxfordian	Tithonian limestone and Anjra are missing of the type section of Lorala l.	Chitten limestone	Samana SubLimestone	Delta Formation	Delta Formation	Chitten limestone
		Uxfordian									
	Upper										
	Middle	Lower	Mazer Drik limestone Thin bedded limestone and shale 80 Ft. (Macrocephalus zone) <i>Cirrhiferus S. bulatus</i>	Polythmus Beds (Macrocephalus zone) ?	Takela limestone	Takela limestone	Samana SubLimestone	Delta Formation	Delta Formation	Delta Formation	Pyrite, argillaceous Limestone (Mazer Drik Limestone) 5 Ft (Macrocephalus Zone)
	Upper	Bethonian	Massive limestone ?	Massive limestone	Anjra formation ?	Shrinab formation	Delta Formation	Delta Formation	Delta Formation	Chitten limestone	
	Lower	Bejocian	Thin bedded dark gray limestone and shale (Arkell lists T. Torcion and doubtful Sinuarmy ammonite found)	Springer In. Dark thin bedded limestone & shale.	Lorala l. dark thin bedded l.	dark, thin bedded limestone and shale with sandstone. Base considered to be Permian	Kingriah Formation	Kingriah Formation	Kingriah Formation	Kingriah Formation	
	Torcion										
	Pilsabachian										
	Sinuarmy										
PERMIAN	Triassic	Metzengian									

TABLE I. CORRELATION OF JURASSIC AND LOWER CRETACEOUS ROCKS OF BALUCHISTAN AND KOHAT-POTWAR AREA.

In the Wam Tangi area, however, the ammonite bed is thin (2 to 3 feet) and is underlain unconformably by the Chiltan limestone, indicating a pre Lower Callovian emergence in this area. It is interesting to point out that around Loralai (which lies north of Nakus and Mazar Drik) the Sembar formation is reported to rest disconformably on Loralai limestone of contended Lower Jurassic age and the Chiltan or Mazar Drik formations are missing (Dean Williams, 1958). Further according to Dean Williams's interpretation, the few feet of limestone exposed below the *Macrocephalites* rocks in the Mazar Drik section are equivalent to the Loralai limestone. If his assignment of Lower Jurassic age for the Loralai limestone is correct, a time gap is indicated between the two formations in Muzari Drik section.

It seems there is a good deal of confusion in the literature regarding the precise ages of the Jurassic rock units in Baluchistan. Different authors have referred them to different formational names and have assigned speculative ages. Until a detailed biostratigraphical investigation of these Jurassic rocks is carried out, their relationship will remain conjectural. This confusion, however, brings out one fact that in Baluchistan rocks of Lower Callovian, Bathonian and possibly Bajocian, are not uniformly distributed and that the overlying Sembar formation ("Belemnite" shale) rest with discordance on rocks ranging in age from Lower Callovian to Lower Jurassic. This further suggests that uniform deposition of sediments was disrupted near the close of Lower Jurassic or early Bajocian times and the sea withdrew from parts of Baluchistan. It was later in late ? Upper Jurassic—Neocomian ("Belemnite" shale) time that a wide spread marine transgression affected whole of Baluchistan and other parts of northern Pakistan.

The evidence from Wam Tangi shows that the sea temporarily withdrew probably in early Middle Jurassic time. The Lower Callovian marine transgression was extremely shallow, as indicated by the condensed pyritic argillaceous ammonite bed, and the overlying pyritic siltstone. The basal beds of the succeeding "Belemnite" shale are again highly pyritic, and nodular and suggest restricted (possibly anaerobic conditions) seas in which erosion may have exceeded deposition, resulting in the development of an important non sequence/disconformity at the close of Lower Callovian.

(b) *Correlation with Cutch*.—The ammonite fauna of Wam Tangi compares very closely with that of the Lower Callovian of Cutch, particularly with that of the Lower and Middle Macrocephalus Bed (Spath 1933, p. 762 ; Arkell 1956, p. 391).

In addition to commonly occurring genera like *Paralcidia* (*P. dubia*), *M. (Indocephalites)*, *M. (Pleurocephalites)*, *M. (Dolikephalites)* and *Choffatia*, Spath (1931, pl. XCVI, fig. 8a, b) has figured one microconch adult form as *Kheraicerias* aff. *cosmopolita* (Parona and Bonarelli) from the Lower Macrocephalus Beds of Jumra. This specimen is closely allied to *K. (Bomburites)* rather than to the subgenus *Kheraicerias*, (Having small adult form with a flared collar at the apertural end) and is very closely comparable to *Bomburites nakusensis* sp. nov. from Wam Tangi. *K. (Bomburites)* does not seem to be restricted to the Lower Callovian of Europe (Arkell, 1957) but is also recognizable from the Lower Callovian of Cutch and Baluchistan.

In Cutch the Lower Callovian ammonite fauna is more fully developed while in Nakus it is difficult to split the assemblage into smaller units due to condensed nature of beds.

(c) *Correlation with Europe*.—A good correlation exists with the Macrocephalus Zone of Europe and England. Calloman (1962) has listed "Macrocephalites" with a supporting fauna of *Choffatia*, *Kepplerites* and *K. (Kheraicerias)* and *K. (Bomburites)*. Excepting for *Kepplerites* and *K. (Kheraicerias)* the rest of the genera are present in the Nakus assemblage.

CONCLUSIONS

This study of a small collection of ammonites from Wam Tangi brings out the following :

1. In the Wam Tangi area of Nakus-Harnai a definite Lower Callovian sequence is developed which rests disconformably on older Jurassic rocks and is overlain with a possible non-sequence by the Sembar formation of doubtful Upper Jurassic—Neocomian age.

The Callovian genera *K. (Bomburites)* and *Paralcidia* are reported for the first time from Pakistan.

3. The presence of a pre Lower Callovian disconformity in the Jurassic sequence of the area is an indication of uplift of some part of Baluchistan in probably early Middle Jurassic time.

4. The fauna is closely comparable with Mazar Drik, Cutch and Europe, and in broad aspect with parts of Africa (Madagascar) and Iran.

5. The study further indicates that rocks of Lower Callovian, Bathonian and possibly Bajocian age are not uniformly distributed throughout Baluchistan and suggest emergence (non deposition) over parts of Baluchistan during the Middle Jurassic.

SYSTEMATIC DESCRIPTIONS

Phylum **MOLLUSCA**
 Class **CEPHALOPODA**
 Sub-Class **AMMONOCIDEA**
 Order **AMMONITIDA**
 Super family : **HAPLOCERATACEAE**
 Family : **OPPELLIDAE**
 Sub-family : **OPPELLINAE Bonarelli 1894.**
 Genus : **PARALCIDIA Spath 1928.**

PARALCIDIA DUBIA (Spath).
 (plate 1, figs. 1, 4.)

1875 *Oppelia subcostaria* (Oppel) Waagen, p. 48, pl. X, fig. 1.

1928 *Alcidia dubia* Spath, p. 82, pl. X, figs. 5a, b.

Material.—One specimen (internal mould).

Horizon.—From a pyritic argillaceous limestone bed above the Chiltan limestone and below the "Belemnite" shales.

Stratigraphic Range.—Lower Callovian.

Description.—The shell is septate, compressed, involute, oxyconic with a fastigate to weakly tricarinate venter. The whorl sides are gently convex converging towards an acute tricarinate venter. The umbilicus is narrow and the umbilical wall is gently inclined first than steeply towards the umbilical seam.

The ornamentation consists of weak, broad ribs which are more distinct on the upper half of whorl side towards the venterolateral margin. Some ribs bifurcate from near the umbilical shoulder. The ribs become much weak towards the adoral end and the shell appear smooth or very weakly ribbed.

Dimensions :

Diameter	Whorl height	Whorl thickness	Umbilical diameter.
32.0 _a mm.	17.0 (53%)	8.0 (25%)	7.0 (22%)
60.0 mm (Holotype)	(50%)	(25%)	(20%)

Remarks.—The described specimen from Nakus strongly resembles in ribbing, whorl section and dimensions (% of diameter) with Waagen's holotype refigured by Spath (1928). It differs however, in dimension from another specimen of the species mentioned by Spath (1928, p 82) which at 30 mm. diameter has a whorl height 47%, whorl thickness 30% and umbilical diameter 27% and thus appears to be less elevated and involute than the Nakus specimen. The described specimen is also comparable in side view, and ornamentation with another species *Paralcidia inflata* (Spath) from the Diadematus Zone of Jumra (Spath, 1928, Pl. X, figs. 3a-b.) but differs in being more involute and less inflated. Some resemblance in venter and whorl section also exist with *Paralcidia mimetica* (Spath) (1928, p. 86, pl. X, fig. 6) but differs in details of ornamentation and whorl section. This is closer to *Paralcidia dubia* reported from Diadematus Zone of Khera, Cutch.

Locality.—Wam Tangi, Nakus, Baluchistan.

Super family : **STEPHANOCERACEAE**
 Family : **TULITIDAE**
 Genus : **KHERAICERAS Spath, 1924.**
 Subgenus : **BOMBURITES Arkell 1952.**

KHERAICERAS (BOMBURITES) NAKUSIENSIS /n. sp

(Plate 2, fig. 1)

1931 *Kheraicerias* aff. *cosmopolita*. (Parona and Bonarelli) Spath, p. 202 (1928), pl. XCVI, figs. 8a, b.

Diagnosis.—Shell adult, small (microconch) of 40 mm. diameter. Inner whorls involute, outer whorl accentrically coiled. Body chamber hook shaped in side view and contracted with a flared collar at the apertural end. Septate whorl cadiconic much more depressed than high, becoming contracted on body chamber. Umbilicus small, oval shape in septate portion enlarging rapidly on the body chamber and the umbilical seam, taking a right angle turn at the adapical end of the body chamber. Ribs rounded rather weak on internal mould, single and bifurcating from near the umbilical and ventral shoulders.

Holotype.—G. S. P. B. 636.

Material.—One Specimen (internal mould).

Horizon.—From a pyritic argillaceous limestone bed above the Chilton limestone and below the "Belemnite" shale.

Stratigraphic Range.—Lower Callovian.

Description.—The shell is small (40 mm. in diameter) adult (microconch) having a hook shaped body chamber which occupies half of the last whorl. The septate whorls are tightly coiled in a spindle shape fashion and has a small oval shape umbilicus. Coiling on the last whorl is accentric. The umbilical seam takes a right angle turn at the beginning of body chamber and the shell uncoils. The umbilical shoulder is fairly well defined and the umbilical wall is steeply inclined, but less so on the body chamber. There is a prominent oblique flared collar at the apertural end, which is followed by a constriction and lip like projection (poorly seen). The septate whorl is cadiconic but the body chamber is contracted.

The primary ribs are rounded, dense and prominent on the septate portion becoming weak on the body chamber. They originate weakly on the upper margin of the umbilical wall near the umbilical shoulder and remain simple or bifurcate from the lower third on the whorl side. The ribs are radial to gently prorsiradiate and cross the venter transversely or with slight forward arching. A few secondary ribs also branch off from near the ventral margin.

There are about 30 to 32 primary ribs at 40 mm. diameter.

Dimensions.

Diameter	Whorl height	Whorl thickness	Umbilical diameter :
40.0 mm.	13.5 (34%)	20.0 (50%)	10.5 (26%)
at 30.0 mm.	15.0 (50%)	20.0 (66%)	5.0 (17%)

Remarks.—Although the subgenus *Bomburites* according to Arkell (1957) is reported from France, the inclusion of Spath's (1931) adult specimen of 36 mm. diameter from Cutch, mentioned above, and the described specimen from Nakus, is preferred here in *Bomburites* than in *Kheraicerus*. All these specimens are adult microconchs and have elaborated apertural structures in contrast to the simple aperture of *Kheraicerus*. It is highly suggestive that *Kheraicerus* represent a macroconch with a simple aperture and *Bomburites* a microconch with a more elaborated aperture.

Locality.—Wam Tangi, Nakus, Baluchistan.

Family: MACROCEPHALITIDAE

Genus: MACROCEPHALITES Zittel 1884

Subgenus: DOLIKEPHALITES Buckman 1923

MACROCEPHALITES (DOIKELPHALITES cf. PERLAMELOSUS Spath.

(Plate 1, figs. 3, 6, 9)

1897 *Macrocephalites subcompressus* (Waagen) Noetling, p. 15, pl. IX, fig. 2.

1933 *Macrocephalites (Dolikephalites) perlamellosus* Spath, p. 808.

Material. Two incomplete specimens (internal moulds).

Horizon.—From a pyritic argillaceous limestone bed above the Chiltan limestone and below the "Belemnite" shale.

Stratigraphic Range. Lower Callovian.

Description.—The larger fragmentary specimens of approximately 80 mm diameter show a typical *Dolikephalites* ribbing. The shell is involute, moderately compressed, much higher than wide. The whorl section is oval with arched venter and whorl sides. The umbilicus is narrow and has a vertical umbilical wall and sharply rounded umbilical shoulder.

The primary ribs are rursiradial on the umbilical wall and shoulder, recurving to prorsiradial on the whorl side. The ribs bifurcate and trifurcate. Some of the trifurcating ribs behave as intercalatory extending to about 2/3rd of the whorl side and merging towards the main bifurcating ones. All the ribs are prorsiradial on the upper half of whorl side but apically the ribs tend to be rectiradial.

Dimensions.

Diameter	Whorl height	Whorl thickness	Umbilical diameter
45.0 mm.	23.0 (51%)	17.0 (38%)	8.0 (18%)
80.0 mm. approx.	42.0 (52%)	24.0 (3%)	14.0 (20%)

Remarks.—In ribbing style and side view the specimens compare well with Noetling's figure from Mazar Drik. Noetling's specimen is, however, of larger diameter and better preserved. The ribbing style and side view is also favourably comparable with *M. (D.) typicus* Blake (1905) from England.

Locality.—Wam Tangi, Nakus, Baluchistan.

Subgenus: INDOCEPHALITES Spath 1928

MACROCEPHALITES (INDOCEPHALITES) cf. DIADEMATUS (Waagen)

(Plate 1, Figs. 2, 7)

1875 *Stephanoceras diadematum* Waagen, p. 130, pl. XXX, figs. 3a-c.

1928 *In-docephalites diadematus* (Waagen) Spath, p. 188, pl. XXI, fig. 7; pl. XXV, fig. 6; pl. XXXI, fig. 5 (see for synonymy).

Material.—Two fragmentary specimens (Internal moulds).

Horizon.—From a pyritic argillaceous limestone bed above the Chiltan limestone and below the "Belemnite" shale.

Stratigraphic Range.—Lower Callovian.

Description.—The species is represented by two fragmentary partly crushed specimens of 60 and 35 mm diameters approximately. The shell is rather evolute, depressed reniform, much wider than high. The umbilicus is narrow on the inner whorl but getting wider on the outer whorl. The umbilical wall is high and steep. The umbilical shoulder is rounded. The whorl sides are convex, converging into a broadly arched venter.

The ribs are moderately coarse, strong, bifurcating near the umbilical shoulder, and some trifurcating higher up rather irregularly.

Dimensions.

Diameter	Whorl height	Whorl thickness	Umbilical diameter
60.0 mm.	23.0 (38%)	41.0 (68%)	16.0 (27%)

The fragmentary specimens from Nakus resembles the Cutch example figured by Waagen (1875) in its evolute shell, depressed whorl section and coarse ribbing. At comparative diameter Waagen's specimen is more evolute and inflated than the described form. It also resembles the small specimen of *M. (I.) diadematus* figured by Spath (1928, pl. XX

fig. 7) from Cutch. In ribbing style and side view the described specimen also compares favourably with *M. (I.) sphaeroidalis* Spath (1928, pl. XXV, fig. 1) but differs in being more depressed. *M. (I.) sphaeroidalis* at 60 mm diameter has a whorl height of 43%, whorl thickness 57% and umbilical width 27%. In ribbing style, whorl section the Nakus example is closely comparable with *M. (I.) aff. chrysoolithicus* (Waagen) Spath (1928, p. 186, pl. XXV, fig. 1) from the Lower Callovian of Khera Hill and which according to Spath is transitional to *M. (I.) diadematus* (Waagen).

Locality.—Wam Tangi, Nakus, Baluchistan.

Subgenus: PLEUROCEPHALITES Buckman 1922.

MACROCEPHALITES (PLEUROCEPHALITES) sp. indet.

(Plate 1, Figs. 5, 8).

Material.—Two very worn fragmentary specimens (internal mould).

Horizon.—From a pyritic argillaceous limestone bed above the Chiltan Limestone and below the "Belemnite" shale.

Stratigraphic Range.—Lower Callovian.

Description.—The specimen described here is badly preserved but in whorl section, ribbing and ventral view favourably compares with *M. (P.)* sp. indet. (*Habyensis* group) Spath (1933, p. 808) which was figured and described by Noetling (1897, p. 17, pl. IX, figs. 3a, b) as *Macrocephalites grantanum* Oppel, from Mazar Drik. The Nakus specimen is also comparable in whorl section with Waagen's (1875, pl. XXXVI, fig. 6a, b) figure from Cutch, which Spath (1928, p. 193) revised and renamed as *M. (P.) habyensis*. The described specimen is, however, closer to Noetling's figure from Mazar Drik than with that of Waagen from Cutch.

Locality.—Wam Tangi, Nakus, Baluchistan.

Super family: PERISPINCTACEAE

Family: PERISPINCTIDAE

Sub family: Pseudoperispinctinae Schindewolf 1928.

Genus: Choffatia Siemiradzki 1898.

Sub genus: Choffatia Siemiradzki 1898.

CHOFFATIA (CHOFFATIA) aff. SOORKAENSIS Spath

(Plate 2, Fig. 3).

1875 *Perispinctes recuperi* (non Gemmellaro) Waagen, p. 172, pl. XLIII, figs. 1a, b.

1931 *Choffatia soorkaensis* Spath, p. 360, pl. LXXV, fig. 4 (see for synonymy).

Material.—Two incomplete weathered specimens (internal mould).

Horizon.—From a pyritic argillaceous limestone bed above the Chiltan limestone and below the "Belemnite" shales.

Stratigraphic Range.—Lower Callovian.

Description.—The shell is incomplete, evolute and 112 mm in diameter. The whorl section is suboval, slightly wider than high. The whorl sides are arched. The umbilicus is wide with a first whorl steeply inclined first and then a vertical wall and rounded umbilical shoulder.

The primary ribs are weak on the umbilical wall, becoming stronger on the umbilical shoulder and extend prominently to about the middle of the whorl sides. They are dense on the inner whorl but, become moderately distant on outer whorl. The ribs are retriradiate first, then become gently prosiridiate on the whorl side. The primary ribs become thin towards the ventral margin and bifurcate on trifurcate from near the middle of whorl side. In addition one or two ribs behave as intercalatory ribs extending to about the middle of whorl side. All the ribs cross the venter transversely but with weakening which is more pronounced on the mid ventral region.

There are 32 primary ribs at 122 mm diameter and 19 per half whorl at 94 mm.

Dimensions.

	Diameter	Whorl height	Whorl thickness	Umbilical diameter
	112.0 mm.	28.0 (25%)	29.0 (approx. (26%))	63.0 (56%)
at	94.0 mm.	24.0 (25.5%)	?	51.5 (55%)
Waagen's at holotype	90.0 mm.	26.0 (29%)	26.0 (29%)	46.0 (51%)

Remarks. The described specimen resembles in whorl shape and ribbing to the one figured by Waagen (1875) but differs in dimensions and in having denser ribs at comparative diameter. The Nakus example is readily distinguished from other *Choffatia* species figured by Waagen (1875) and Spath (1928-33) from Cutch and by Noetling (1897) from Baluchistan.

Locality. Wam Tangi, Nakus, Baluchistan.

Sub genus: *Homoeoplanulites* Buckman 1922.

CHOFFATIA (? *HOMOEPLANULITES*) sp. indet.

(Plate 2, Fig 2).

Material. Two incomplete poorly preserved specimens (internal moulds).

Horizon. From a pyritic argillaceous limestone bed above the Chiltan limestone and below the "Belemnite" shale.

Stratigraphic Range. Lower Callovian.

Description.—The shell is evolute and 50 mm in diameter. The whorl section tend to be rounded, with whorl height equalling whorl thickness. The umbilicus is wide, and has a steep to vertical umbilical wall with a rounded umbilical shoulder. Two to three constrictions oblique to the ribs are present. The constriction at the adoral end suggest the beginning of the body chamber.

The primary ribs are dense, gently to moderately prorsiradial, bifurcating from the middle or slightly above, on the whorl side. In addition a few short inter-calatory ribs are located which either merge to form trifurcation or remain independent. All the ribs cross the venter transversely and with slight weakening.

Dimensions.

Diameter	Whorl height	Whorl thickness	Umbilical diameter
50.0 mm.	16.0 (32%)	15.5 (31%)	27.0 (54%)

Remarks. In dense ribbing and presence of constrictions the species is comparable with *Choffatia balinensis* (Neumayr) as figured by Noetling (1897, pl. XIII, figs. 1, 3; and also mentioned by Spath 1933, p. 808). In ribbing style and rounded whorl section the specimens also resembles *Choffatia* (*C*) *recuperoi* (Gemmellaro) as figured by Noetling (1897, pl. XIII, fig. 4) from Mazar Drik but differs in having denser and finer ribs. From *Choffatia* (*C*) *baluchistanensis* (Noetling) it is distinguished by its more evolute shell and less elevated whorl section.

The species is doubtfully placed in the subgenus *Homoeoplanulites* as it does not show distinct modification of ribs and is comparatively small in size. The subgenus was previously known from Europe only (Arkell 1957).

Locality. Wam Tangi, Nakus, Baluchistan.

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PLATE 1

(All figures are natural size.)

FIGS. 1, 4

Paralocidia dubia (Spath), fig. 1 side, fig. 4 ventral views of a weathered specimen from the ammonite bed above the Chiltan limestone, Wam Tangi, Nakus, B 635.

FIGS. 2, 7

Macrocephalites (*Indocephalites*) cf. *diadematus* (Waagen), fig. 2 front view of specimen B 638(2), fig. 7 side view (tilted) of another weathered specimen B 638(1) with outline of whorl section from the ammonite bed above the Chiltan limestone, Wam Tangi, Nakus.

FIGS. 3, 6, 9

Macrocephalites (*Dolikephalites*) cf. *perlamellosus* Spath figs 3, 6 side and ventral view of a septate specimen B 637 (2) and fig. 9 side view with outline of whorl section of another fragmentary specimen B 637 (1).

FIGS. 5, 8

Macrocephalites (*Pleurocephalites*) sp. indet, fig 5 ventral view, and fig. 8 outline of whorl section of a weathered specimen B 639, from the ammonite bed above the Chiltan Limestone, Wam Tangi Nakus.



1



2



3



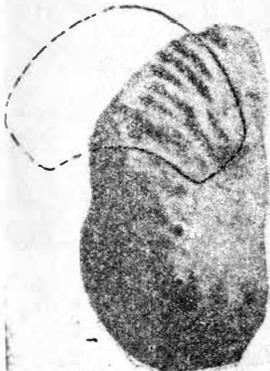
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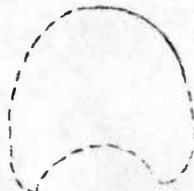
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6



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8



9

PLATE 2

(All figures are natural size)

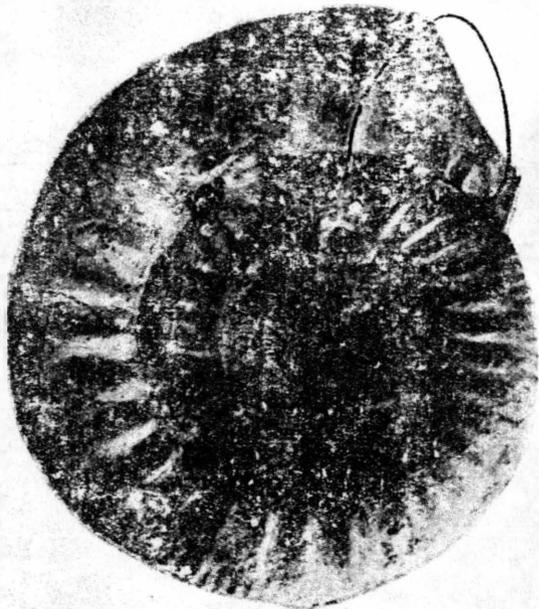
- FIG. 1** ↪ *Kheraiceras (Bomburites) nakusiensis* sp. nov. side view of an adult partly worn specimen (holotype) B 636 from the ammonite bed above the Chiltan Limestone, Wam Tangi, Nakus.
- FIG. 2** ↪ *Choffatia* (? *Homoepanulites*) sp. indet. side view of a weathered specimen B 641 from the ammonite bed above the Chiltan Limestone, Wam Tangi, Nakus.
- FIG. 3** *Choffatia (Choffatia)* aff. *soorkaensis* Spath. side view with outline of whorl section of an incomplete weathered specimen B 640 from the ammonite bed above the Chiltan Limestone, Wam Tangi, Nakus.



1



2



3