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## DISCOVERY OF *CLYDONICERAS* BLAKE AND *GRACILISPHINCTES* BUCKMAN (BATHONIAN–MIDDLE JURASSIC AMMONITES) IN KACHCHH, WESTERN INDIA

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**ABSTRACT**—*Clydoniceras* Blake and *Gracilisphinctes* Buckman (Bathonian–Middle Jurassic ammonites) have been reported for the first time from Kachchh, western India. These ammonites are briefly described and illustrated in this paper and their stratigraphic significance is discussed.

### INTRODUCTION

THE JURASSIC rocks of Kachchh have attracted the attention of paleontologists for several decades because of their diversified organic assemblages. Of these, the bivalves and cephalopods have been the most sought after and best studied groups. The ages of the Kachchh strata have been determined mainly on the basis of these two groups, particularly the latter. Spath (1933, p. 716–721) assigned a Bathonian age to some of the older beds (Pacham Group—Coral beds and below) of the Kachchh Jurassic sequence, based on the presence of *Macrocephalites triangularis* Spath, *Kamptokephalites dimerus* (Waagen), *Epimorphoceras decorum* (Waagen), *Procerites hians* (Waagen) and *Sivajiceras congener* (Waagen). The first two forms were later considered to indicate a lower Callovian age (Arkell, 1956; Agrawal, 1956). Arkell considered the genera *Macrocephalites* Zittel and *Epimorphoceras* Spath to be of lower Callovian age, *Sivajiceras* Spath to be middle Callovian and *Procerites* Siemiradzki to be lower to middle Bathonian (and perhaps lower Callovian) (in Moore et al., 1957, p. L294, L312, L315, L317). Therefore, the beds in Kachchh yielding this assemblage should be considered to represent the Callovian, not the Bathonian. No ammonites have been previously described from the pre-Callovian sediments of Kachchh, although the bivalve assemblage from there, consisting of *Corbula lyrata* J. de C. Sowerby, *Protocardia grandidieri* Newton, *Eomiodon baroni* (Newton) and *Pseudotrapezium* sp. is considered to indicate a Bathonian age. Either on the basis of this bivalve assemblage (Singh and Rai, 1980) or simply their stratigraphic position

below the *Macrocephalites*-bearing beds (Kanjilal, 1978), these strata were dated as Bathonian.

The present authors have found for the first time from India well preserved Bathonian ammonites in the pre-Callovian beds of Gora Dongar hills (latitudes 23°44'N to 23°52'N and longitudes 69°44'E to 69°59'E) in the southern part of Kachchh Island (latitudes 23°40'N to 24°N and longitudes 69°41'E to 69°59'E), district Kachchh (Gujarat). They occur below a 95.5-m-thick sequence of Callovian sediments of which the lower 95 m of strata, consisting of yellow to yellowish brown limestone with "Golden Oolite" and intercalated shale bands, have yielded *Macrocephalites* (*Macrocephalites*) *formosus* (J. de C. Sowerby), *M. (M.) chariensis* (Waagen), *M. (M.) triangularis* Spath, *M. (M.) madagascariensis* Lemoine, *M. (Dolikephalites) subcompresus* (Waagen), *M. (Kamptokephalites) lamellosus* (J. de C. Sowerby), *M. (K.) magnumbilocatus* (Waagen), *M. (K.) dimerus* (Waagen), *M. (Pleurocephalites) habyensis* Spath, *M.?* (*Indocephalites*) *transitorius* Spath, *M.?* (*I.*) *kheraensis* Spath, *M.?* (*I.*) aff. *kheraensis* Spath and *M.?* (*I.*) *chrysoolithicus* (Waagen). A bed of yellow shale, about 6.5 m thick, associated with "Golden Oolite" bands and separated from the lowest *Macrocephalites*-bearing bed by a two-meter-thick barren sandstone, has provided well preserved specimens of *Gracilisphinctes* Buckman and *Clydoniceras* Blake. This is underlain by a 1.5-m-thick shelly limestone bed with "Golden Oolite" which too has yielded *Clydoniceras* Blake. The underlying sediments, approximately 60 m thick, have not yielded ammonites.

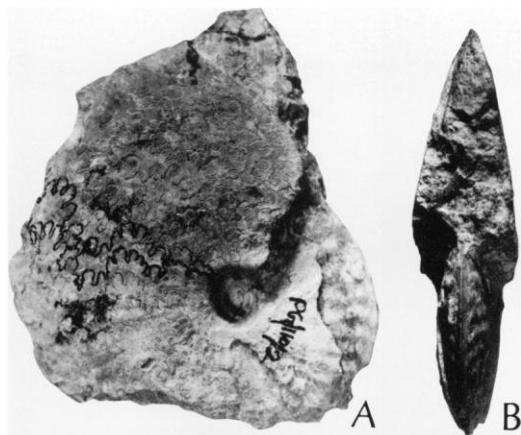


FIGURE 1—*Clydoniceras* sp. (PG/110/2) from yellow shale associated with “Golden Oolite” (middle Bathonian), northwest of the village of Sadhara, Pachchham Island, Kachchh. A, side view; B, apertural view; both  $\times 0.54$ .

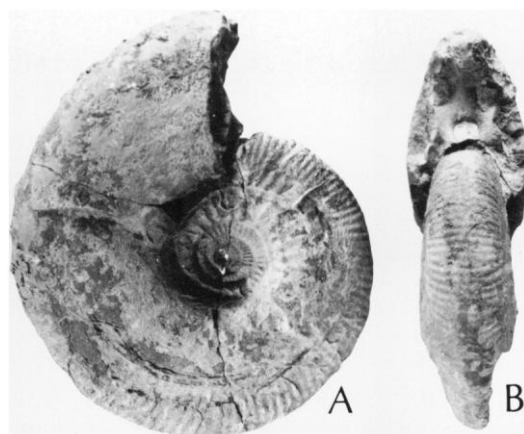


FIGURE 2—*Gracilisphinctes arkelli* Collignon (PG/208/1) from yellow shale associated with “Golden Oolite” (middle Bathonian), north of Khari, Pachchham Island, Kachchh. A, side view; B, apertural view; both  $\times 0.27$ .

*Gracilisphinctes* is known from the middle Bathonian (also doubtfully from the upper Bathonian) while *Clydoniceras* ranges from middle to upper Bathonian (Arkell, in Moore et al., 1957, p. L291, L316). Thus, the pre-Calloviaian sediments up to the *Clydoniceras*-bearing beds probably should be considered as being of middle Bathonian age. The lower 60 m of sediments may, for the present, be regarded as representing lower middle or middle Bathonian. Thus in Gora Dongar the oldest sediments are Bathonian in age.

A brief description and illustrations of these genera (*Clydoniceras* and *Gracilisphinctes*) are given. The described specimens are lodged in the Department of Geology, Banaras Hindu University, Varanasi 221005, India. All measurements are in millimeters; the following abbreviations are used: D = diameter; H = height; T = thickness; U = umbilicus. Figures in parentheses after “height,” “thickness” and “umbilicus” represent their percentage with respect to diameter.

#### SYSTEMATIC PALEONTOLOGY

Class CEPHALOPODA Leach, 1817  
 Order AMMONOIDEA Zittel, 1884  
 Suborder AMMONITINA Hyatt, 1889  
 Superfamily STEPHANOCERATACEAE  
 Neumayr, 1875

#### Family CLYDONICERATIDAE

Buckman, 1924

Genus CLYDONICERAS Blake, 1905

*Type species.*—*Ammonites discus* J. Sow-  
 erby, 1813, Lower Cornbrash, England.

#### CLYDONICERAS sp.

##### Figure 1

*Material.*—One specimen.

*Horizon and locality.*—Yellow shale, associated with “Golden Oolite” (middle Bathonian), northwest of Sadhara (Pachchham Island, Kachchh).

*Brief description.*—Phragmocone compressed; earlier whorls with prominent sharp keel, later acute; involute. Umbilicus step-like; umbilical wall low and vertical. Maximum whorl thickness at about the dorsal third of the whorl height.

Flanks ornamented with flattened, gently falcoid, irregularly bifurcating ribs, terminating just short of the sharp periphery at slightly thickened ends on inner whorls; outer whorl bearing ribs of low relief. Whorl surface surrounding umbilicus smooth. Suture typical of the genus (*Clydonian* type).

*Dimensions.*—Measurements for the single specimen (PG/110/2) are: D = 93.5; H = 51.5 (55.0); T = 20.9 (22.3); T/H = 0.40; U = 10.5 (11.2).

TABLE 1—Ammonite succession in Gora Dongar, Pachchham Island, Kachchh.

Age	Lithology and thickness		Ammonite fauna
Tertiary	Laterite with conglomerate at the base		
	b—Yellow limestone	0.5 m	<i>Subgrossouvria</i> spp.
Callovian	a—Yellow to yellowish brown limestone with "Golden Oolite" and intercalated shale bands	95 m	<i>Parapatoceras</i> sp. <i>Macrocephalites</i> spp. <i>M. (Dolikephalites)</i> sp. <i>M. (Kamptophalites)</i> spp. <i>M. (Pleurocephalites)</i> sp. <i>M.?</i> ( <i>Indocephalites</i> ) sp. <i>Choffatia</i> sp.
Jurassic	d—Barren friable sandstone	2 m	—
	c—Yellow shale, associated with "Golden Oolite"	6.5 m	<i>Gracilisphinctes</i> spp. <i>Clydoniceras</i> sp.
	b—Shelly limestone with "Golden Oolite"	1.5 m	<i>Clydoniceras</i> sp.
	a—Sandstone	60 m	—

**Remarks.**—The discoid, keeled and involute whorls, later becoming oxyconic, the fal-coid ribbing and the Clydonian-type suture validate identification of this specimen with *Clydoniceras*. The most similar known species is *C. discus* (J. Sowerby, 1813, p. 37, Pl. 12; also see Blake, 1905, p. 54, Pl. 6, fig. 1, text-fig. 5) which, however, barely possesses an umbilicus and is slightly less compressed. *C. (C.) discus* (J. Sowerby) from northwest Germany (Westermann 1958, p. 56, Pl. 11, figs. 9a, b, Pl. 12, figs. 1a, b, 2a, b, 3a, b) is more finely ribbed.

Superfamily PERISPINCTACEA  
Steinmann, 1890

Family PERISPINCTIDAE Steinmann, 1890

Subfamily ZIGZAGICERATINAE  
Buckman, 1920

Genus GRACILISPINCTES Buckman, 1920

**Type species.**—*Ammonites gracilis* J. Buckman 1844 (*non* Zieten, 1830) (= *Procerites progracilis* Cox and Arkell, 1950). Stonesfieldian; England.

GRACILISPINCTES ARKELLI Collignon  
Figure 2

*Gracilisphinctes arkelli* COLLIGNON, 1958, Pl. 6, figs. 31–33.

**Material.**—Eight specimens.

**Horizon and localities.**—Yellow shale associated with "Golden Oolite" (middle Bathonian), north northwest of Khari and

north northwest of Sadhara (Pachchham Island, Kachchh).

**Brief description.**—Phragmocone compressed, moderately evolute and constricted. Whorl section subtrigonal, with maximum thickness at about dorsal two-fifths of whorl height. Flanks feebly arched, converging toward narrow rounded venter.

Ornamentation consisting of about 35–40 obtuse, rectiradiate primary ribs per whorl, splitting into two or three secondaries at about mid-height of the whorls, from where they are slightly prorsiradiate but pass straight over the venter.

Three constrictions per whorl present up to a diameter of about 105 mm; constrictions absent at greater diameters.

**Dimensions.**—Measurements for specimen PG/208/1 are: D = 210; H = 95.0 (45.2); T = 64.5 (30.7); T/H = 0.67; U = 55.0 (26.1). Another specimen's (PG/268/1b) measurements are: D = 65; H = 28.0 (43.0); T = 25.0 (38.4); T/H = 0.89; U = 23.0 (35.3).

**Remarks.**—These large, planulate shells can be distinguished from *Procerites* Siemiradzki by their constrictions and more evolute inner whorls. They agree well with *G. arkelli* Collignon (1958, Pl. 6, figs. 31–33) in dimensional proportions, whorl section and ornamentation. Further, three constrictions per whorl is a characteristic feature of *G. arkelli*.

The holotype and other examples of the European species *G. progracilis* (Cox and Ar-

kell) as discussed by Arkell (1958, p. 197, Pl. 27, fig. 5, Pl. 28, figs. 1–4, text-figs. 63, 72–74) can be easily distinguished by its more evolute form, less trigonal whorl section, and slightly coarser ribbing.

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