THE SYSTEMATIC STATUS OF OPPEL'S SPECIMENS OF *BELEMNITES GERARDI*

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ABSTRACT. Oppel's original specimens of *Belemnites gerardi* from Kalabagh (Punjab) are described and refigured. The name is restricted to the specimens figured as Oppel's pl. 88, figs. 1, 2, and the original of fig. 3 is assigned to a new species, *Belemnopsis uhligi*, based on one of Uhlig's specimens from the Spiti Shales (northern India). Synonymy and diagnoses are provided for *B. gerardi* and *B. uhligi* and their stratigraphic ranges discussed. It is shown that *Belemnopsis kuntkotensis* (Waagen) is a synonym of *B. gerardi* and that the majority of belemnites hitherto assigned to *B. gerardi* should be reassigned to *B. uhligi*.

THE species usually known as *Belemnopsis gerardi* (Oppel), e.g. as interpreted by Uhlig (1903–10, pp. 386–8), is a common belemnite of the Kimeridgian of the Indo-Pacific region, having been recorded from numerous localities in Indonesia (Kruizinga 1921; Stolley 1929, 1934, 1935) and northern India (Oppel 1863; Uhlig 1903–10). Related species have been recorded from East Africa (Tate 1867), northern Australia (Teichert 1940), New Caledonia (Avias 1953), and New Zealand (Marwick 1953).

The name was introduced in 1863 (Oppel 1863, p. 273), but the species was not described and figured until 1865 (Oppel 1865, pp. 296–7). Study of the species has been hampered by lack of adequate figures and descriptions of Oppel's original specimens (1865, pl. 88, figs. 1–3). Through the courtesy of Dr. K. Werner Barthel of the Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich, the writer has been able to examine these specimens.

The species was based on two complete specimens (Oppel 1865, pl. 88, figs. 1, 2), and a third incomplete specimen (fig. 3) which was only tentatively referred to the species by Oppel. All three specimens are preserved in the Schlagintweit Collection in Munich and are labelled '*Macrocephalus*-schichten, Kalabagh im Ob. Punjab'. The accession numbers are as follows: 1872. xv. 502 (Oppel 1865, pl. 88, fig. 1); 1872. xv. 501 (fig. 2); 1872. xv. 46 (fig. 3). Kalabagh (32° 58′ S., 71° 36′ E.) is on the right bank of the Indus, some 70 miles south of Peshawar.

Previous workers have agreed that more than one species is represented by Oppel's specimens, but there has been no agreement on the identity of these species. In 1929 Stolley examined Oppel's specimens, and based his concept of the species (1929, pp. 147, 151) on Oppel's fig. 3 (Oppel 1865, pl. 88). He identified Oppel's fig. 1 as *Belemnopsis aucklandica* (Hauer) (1929, pp. 151, 168) and fig. 2 as *B. alfurica* (Boehm) (op. cit., pp. 151, 172). Spath (1927–33, pp. 661–2) supported Stolley's identification of Oppel's fig. 2 as *B. alfurica*, but did not agree that fig. 1 represents a specimen of *B. aucklandica*. Spath rejected Stolley's choice of the original of Oppel's fig. 3 as the type (properly a lectotype) for *B. gerardi*, as this specimen was only tentatively referred to the species by Oppel. Spath took two of Uhlig's specimens (1903–10, pl. 93, figs. 5, 7) to be typical *B. gerardi* of the Spiti Shales, though Stolley disagreed with this selection (Spath 1927–33, pp. 4, 661). Teichert (1940, p. 114) designated Oppel's fig. 1 as type (lectotype) for

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B. gerardi. This appears to be the first valid selection of lectotype for Oppel's nominal species and is accepted here.

The original of Oppel's pl. 88, fig. 3 (Pl. 98, figs. 9–13; Pl. 99, fig. 4) is a fragment of the alveolar region, 52 mm. in length. Measurements are as follows (in mm.):

Posterior end
Transverse diameter (dt): 21·5 Sagittal diameter (ds): 21·5
Anterior end:
dt: 23·0 ds: 22·0
At the approximate position of the protoconch:
dt: 22·0 ds: 21·5

The guard is massive and non-hastate, with a well-developed ventral groove. The groove is 7 mm. wide where dt = 22·0 mm., and 3 mm. deep where ds = 21·5 mm. Lateral lines and a dorsal groove appear to be absent.

The originals of Oppel's pl. 88, figs. 1 and 2 (Pl. 98, figs. 1–8) are reasonably complete and their measurements (in mm.) are given below (for explanation of abbreviations see Avias 1953, pp. 158–9).

Oppel	*l*	*u*	*v*	*dtM*	*dtm*	*dsM*	*dsm*	*u/v*	*Ht*	*Hs*	*A*	*Rs*
Fig. 1	65	26	39	9·5	8·5	8·5	9·0	0·66	111·7	94·4	111·7	0·27
Fig. 2	72	27	45	11·5	10·5	10·5	11·0	0·6	109·5	95·4	109·5	0·3

In the original of fig. 2 (Pl. 98, figs. 5–8) the guard is elongate and sharply pointed. The outline and profile are symmetrical, and in both the sides gradually taper towards the apex. The outline of the guard is slightly hastate. The ventral groove reaches almost to the apex, and is broad and moderately shallow in relation to the dimensions of the guard. The groove is 1 mm. deep where ds = 10·5 mm., and 3·5 mm. wide where dt = 11·5 mm. Lateral lines are not visible, and a dorsal groove is absent. The cross-section of the guard is depressed in the apical and stem regions, but becomes compressed in the alveolar region.

The original of fig. 1 (Pl. 98, figs. 1–4) is a juvenile and is more hastate than that of fig. 2, but otherwise shows the same characters. Traces of lateral lines are present on the flanks. This specimen appears to have been slightly distorted; the apical region has been bent in a dorsal direction, producing an apparent downwarping of the posterior portion of the guard. Notwithstanding this distortion, it appears that the original specimens of Oppel's figs. 1 and 2 are of the same species, and distinct from Oppel's fig. 3. Boehm (1907, p. 55) refigured the cross-sections of Oppel's pl. 88, fig. 1*c* (ibid., fig. 20), and pl. 88, fig. 3*b*, *c* (ibid., figs. 21*a*, *b*); and as may be seen from these, the cross-section of fig. 1 (compressed) is quite different from that of fig. 3 (circular). The characters of the originals of Oppel's figs. 1 and 2 are identical with those of *Belemnopsis kuntkotensis* (Waagen) recorded from Upper Oxfordian localities in Kachh by Waagen (1873, pp. 3–5) and Spath (1927–33, pp. 8, 9).

Waagen's description of *B. kuntkotensis* applies perfectly to the originals of Oppel's figs. 1 and 2, except that he mentions the presence of a dorsal alveolar groove which cannot be identified in Oppel's specimens because of their incompletely preserved alveolar regions. This feature, however, is usually impersistent in *Belemnopsis* and has no significance (cf. Spath 1927–33, pp. 662–3).

Like many species of *Belemnopsis*, *B. kuntkotensis* becomes less hastate with maturity.

Whereas the juvenile is hastate (as noted by Waagen 1873, p. 4) the adult is almost non-hastate (e.g. Waagen's type of *B. kuntkotensis*; Waagen 1873, pl. 1, figs. 3*a–e*; Spath 1927–33, pl. 1, fig. 1*b*). The type of *B. kuntkotensis* is evidently a more mature stage than the originals of Oppel's figs. 1 and 2, with fig. 2 representing a later stage than fig. 1. In the table below the measurements of the juvenile specimen identified by Spath (1927–33) as *B.* aff. *kuntkotensis* (ibid., pl. 2, fig. 4) are given, along with the measurements of Waagen's holotype, taken from Waagen (1873, p. 4) and Spath's figure (1927–33, pl. 1, fig. 1*b*). The original of Spath's pl. 1, fig. 1*a* (BMNH C19921) is too crushed to provide accurate measurements.

	l	*u*	*v*	*dtM*	*dtm*	*dsM*	*dsm*	*u/v*	*Ht*	*Hs*	*A*	*Rs*	
Spath 1927–33, pl. 2, fig. 4. BMNH, C19943.	46	16	30	8·5	7·0	6·7	7·0	0·53	121·4	95·7	126·8	0·33	Juvenile
Waagen's holotype; measurements taken from Waagen 1873, p. 4, and Spath 1927–33, pl. 1, fig. 1*b*	78	20 Est.	58 Est.	11·5 Est.	11·0	11·0 Est.	12·0	0·34	104·5	91·6	104·5	0·29	

The original of Oppel's fig. 3 conforms in its characters to those of specimens usually identified by previous workers as *Belemnopsis gerardi*. But as fig. 3 is not a specimen in Oppel's type series, its designation by Stolley (1929) as lectotype for *gerardi* is invalid and Teichert's designation (1940, p. 114) of the original of fig. 1 must be accepted. Therefore the name *gerardi* must take precedence over *kuntkotensis* and a new species proposed for belemnites resembling the original of Oppel's fig. 3, previously identified as *B. gerardi*. *Belemnopsis gerardi* is redefined below and a new species, *Belemnopsis uhligi*, proposed.

SYSTEMATIC DESCRIPTIONS

Belemnopsis gerardi (Oppel)

Plate 98, figs. 1–8

1863 *Belemnites gerardi* Oppel, p. 273 (*nom. nudum*).
1865 *Belemnites gerardi* (*partim*) Oppel, pp. 296–7, pl. 88, figs. 1, 2 (*non* fig. 3).
1873 *Belemnites kuntkotensis* Waagen, pp. 3–5, pl. 1, fig. 3.
1879 *Belemnites grantianus* d'Orbigny; Medlicott and Blanford, pl. 12, fig. 2.
1893 *Belemnites grantianus* d'Orbigny; Oldham, pp. 222–4.

EXPLANATION OF PLATE 98

Figs. 1–4. *Belemnopsis gerardi* (Oppel). Lectotype. Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 502, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 1. 1, Ventral view. 2, Dorsal view. 3, Left lateral view (i.e. ventral groove facing left). 4, Right lateral view. All ×1.

Figs. 5–8. *Belemnopsis gerardi* (Oppel). Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 501, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 2. 5, Ventral view. 6, Dorsal view. 7, Left lateral view. 8, Right lateral view. All ×1.

Figs. 9–13. *Belemnopsis uhligi* sp. nov. Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 46, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 3. 9, Cross-section, stem region. 10, Cross-section, alveolar region. 11, Ventral view. 12, Dorsal view. 13, Left lateral view. All ×1. See also Plate 99, fig. 4.

1907 *Belemnites gerardi* Oppel (*partim*); Boehm, p. 55, fig. 20 (*non* figs. 21*a*, *b*).
1927–33 *Belemnopsis kuntkotensis* (Waagen), *B.* aff. *kuntkotensis*; Spath, pp. 8–9, pl. 1, figs. 1*a*, *b*; pl. 2, fig. 4.
cf. 1929 *Belemnites tanganensis* Futterer; Weir, p. 18, pl. 2, fig. 23; pl. 5, figs. 19, 20.
cf. 1930 *Belemnopsis tanganensis* (Futterer); Weir, p. 90, pl. 10, fig. 3.
cf. 1933 *Belemnopsis tanganensis* (Futterer) (*partim*); Stefanini, pp. 47–50, pl. 4, figs. 3–5 (*non* figs. 2, 6–17).
? cf. 1934 *Belemnopsis tanganensis* (Futterer); Spath, pp. 21, 22.
1935 *Belemnopsis kuntkotensis* (Waagen); Spath, p. 207, pl. 24, fig. 4.
1939 *Belemnopsis gerardi* (Oppel) (*partim*); Spath, pp. 110, 111, pl. 24, fig. 12 (*non* figs. 11, 13).
1951 *Belemnopsis* aff. *kuntkotensis* (Waagen); Nicolaï, pp. 33, 34.
? var. 1953 *Belemnopsis kuntkotensis* (Waagen) var. *puenensis* Avias, pp. 156–7, 164–5, pl. 14, figs. 4, 9, 12, 13, 15; pl. 15, figs. 24, 30, 31, 34, 36–39; pl. 16, figs. 5, 11, 17.
1956 *Belemnopsis kuntkotensis* (Waagen); Hunt, p. 12.
non 1845 *Belemnites grantianus* d'Orbigny, p. 307, pl. 58.
non 1873 *Belemnites gerardi* Oppel; Waagen, pp. 13, 14, pl. 2, fig. 3 (see Spath 1927–33, pl. 1, fig. 3*a*).
non 1894 *Belemnites tanganensis* Futterer, pp. 30–32, pl. 5, figs. 2, 3.
non 1935 *Belemnopsis kuntkotensis* (Waagen); Spath, p. 218 (original of Spath 1927–33, pl. 1, fig. 3*b*).

Diagnosis. A *Belemnopsis* with an elongate and tapering guard. Outline and profile symmetrical, sides and ventral and dorsal surfaces gradually tapering towards the apex. Outline slightly hastate, more so in sub-mature forms. Apex not inflated, tapering. Depressed cross-sections in apical and stem regions, compressed in alveolar region. Ventral groove deep and moderately broad, extending from alveolar region and almost reaching apex. Groove deepest in alveolar region, gradually shallowing towards apex. Poorly developed lateral lines and dorsal alveolar groove may or may not be present.

Lectotype. Original of Oppel 1865, pl. 88, fig. 1, accession number 1872. XV. 502, Schlagintweit Collection, Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich. Designated Teichert 1940, p. 114 (see also Glaessner 1945, p. 155).

Type locality. Kalabagh, Upper Punjab.

Localities and stratigraphic range. Upper Oxfordian–Middle Kimeridgian.

The species occurs in the Punjab (Pakistan) and Kachh (India), Somalia, Madagascar, and probably in Kenya and New Caledonia. In the Kachh sequence it is known from the Kantkot (Kuntkote) Sandstone (Upper Oxfordian) and in Somalia from the lower part of the Daghani Shales (Middle Kimeridgian). The Madagascar and New Caledonia occurrences have been dated as Upper Oxfordian to Lower Kimeridgian.

The precise age of the beds at Kalabagh is unknown. Spath (1927–33, pp. 661–2), influenced by Stolley's work on Indonesian belemnites, favoured an Upper Oxfordian age for *B. gerardi* from Kalabagh. His opinion changed, however, and he later stated (Spath 1939, p. 110; see also 1927–33, p. 802) that there was no evidence for an Upper Oxfordian age for Oppel's specimens of *B. gerardi*, and implied that they came from beds nearly equivalent to the Chidamu Beds of Spiti (i.e. Lower Tithonian).

Both *B. gerardi* (Oppel's figs. 1 and 2) and *B. uhligi* (fig. 3) occur at Kalabagh, but their stratigraphic relationship is unknown. In New Zealand species allied to *B. uhligi* first appear in the Middle Kimeridgian and range up to Lower or Middle Tithonian. Therefore if all three of Oppel's specimens came from approximately the same horizon, a Middle Kimeridgian age is favoured.

Belemnopsis uhligi sp. nov.

Plate 98, figs. 9–13; Plate 99, figs. 1–9

1833 Belemnites; Everest, pl. 1, fig. 17.
1863 *Belemnites sulcatus* Miller; Blanford, p. 125, pl. 1, figs. 1, 2*a–c*.
1865 *Belemnites gerardi* (*partim*) Oppel, pp. 296–7, pl. 88, fig. 3 (*non* figs. 1, 2).
1866 *Belemnites canaliculatus* Schlotheim; Stoliczka, pp. 111–12.
1889 *Belemnites gerardi* Oppel (*partim*); Neumayr, pp. 52–56 (only references to Oppel's fig. 3).
? aff. 1892 *Belemnites gerardi* Oppel (*partim*); Rothpletz, pp. 104–5, pl. 13, fig. 10 (*non* figs. 6–8, 12).
1903–10 *Belemnites* (*Belemnopsis*) *gerardi* Oppel (*partim*); Uhlig, pp. 386–8, pl. 93, figs. 5, 7, 9 (*non* pl. 93, figs. 1, 2, 10–13; pl. 93A, figs. 1, 2, 4, 5).
1907 *Belemnites gerardi* Oppel (*partim*); Boehm, p. 55, figs. 21*a*, *b* (*non* fig. 20).
1920 *Belemnopsis gerardi* (Oppel) (*partim*); Bülow-Trummer, pp. 129–30 (*non* occurrences in S. Africa, N. Alps, and France).
1921 *Belemnopsis gerardi* (Oppel); Kruizinga, pp. 163–6, pl. 1, figs. 1–4; pl. 2, fig. 11.
? 1927–33 *Belemnopsis* cf. *gerardi* (Oppel); Spath, pp. 706–7.
1929 *Belemnopsis gerardi* (Oppel) (*partim*); Stolley, pp. 151–7, pl. 1, figs. 18, 20, 22, 24–29; pl. 2, figs. 1–3 (*non* pl. 1, figs. 16, 17, 19, 21, 23, 30–32).
1931 *Belemnopsis gerardi* (Oppel); Kruizinga, p. 368.
1931 *Belemnopsis gerardi* (Oppel); Wanner, pp. 585–95.
1934 *Belemnopsis gerardi* (Oppel) typ.; *Belemnopsis* aff. *gerardi*; Stolley, pp. 470–86.
1935 *Belemnopsis gerardi* (Oppel); Stolley, pp. 49, 50.
aff. 1939 *Belemnopsis gerardi* (Oppel) (*partim*); Spath, pp. 110–11, pl. 24, figs. 11, 13 (*non* fig. 12).
1945 *Belemnopsis gerardi* (Oppel); Glaessner, pp. 155–6, pl. 6, figs. 8, 9.
1956 *Belemnopsis gerardi* (Oppel); Marks, pp. 199, 200.
ex. gr. 1956 *Belemnopsis gerardi* (Oppel); Wanner, p. 135.
1956 *Belemnopsis gerardi* (Oppel); Arkell, pp. 408, 447.
1957 *Belemnopsis gerardi* (Oppel); Holland *et al.*, pp. 86, 160, 247.
non 1820 *Belemnites canaliculatus* Schlotheim, p. 49.
non 1823 *Belemnites sulcatus* Miller, p. 59, pl. 8, figs. 3–5.
non 1873 *Belemnites gerardi* Oppel; Waagen, pp. 13, 14, pl. 2, fig. 3.
non 1895 *Belemnites gerardi* Oppel; Kilian, p. 673.
non 1914 *Belemnites sp.*, related to *B. gerardi*; Spitz, pp. 222–3, pl. 19, figs. 11, 12.
non 1924 *Belemnites gerardi* Oppel; Broili, pp. 8, 9; pl. 2, fig. 9.
non 1951 *Belemnopsis* cf. *gerardi* (Oppel); Brunnschweiler, p. 8.
non 1958 *Belemnopsis* cf. *gerardi* (Oppel); McWhae *et al.*, p. 90.

Diagnosis. A *Belemnopsis* with a short robust guard, cylindrical or cylindro-conical. Outline and profile symmetrical, both non-hastate. Apex not inflated, usually tapering. Apical, stem, and alveolar cross-sections usually circular. Ventral groove broad and deep,

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EXPLANATION OF PLATE 99

Figs. 1–3, 5. *Belemnopsis uhligi* sp. nov. Holotype. Upper Jurassic (Spiti Shales) of the Niti Pass area, northern India. Accession No. 10161, Geological Survey of India Museum, Calcutta. Original of Uhlig 1903–10, pl. 93, figs. 9*a*, *b*. 1, Ventral view. 2, Dorsal view. 3, Right lateral view (ventral groove facing right). 5, Cross-section at anterior end. All ×1.

Fig. 4. *Belemnopsis uhligi* sp. nov. Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 46, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 3. Right lateral view, × 1. See also Plate 98, figs. 9–13.

Figs. 6–9. *Belemnopsis uhligi* sp. nov. Upper Jurassic (Uppermost Fatjet Shales) of Fatjet, Misol Archipelago, Indonesia. Accession No. 116/1, Weber Collection (Locality M.36, see Stolley 1934, p. 484), Naturhistorisches Museum, Basel. 6, Ventral view. 7, Dorsal view. 8, Left lateral view. 9, Right lateral view. All ×1.

extending from alveolar region to apex. Groove deepest in alveolar region, gradually shallowing towards apex. Lateral lines not observed.

Holotype. Original of Uhlig 1903–10, pl. 93, figs. 9*a*, *b*. No. 10161, Geological Survey of India collections, Calcutta.

Type locality. Spiti Shales, Jandu, Hundes (Niti Pass area, Tehri Garhwal and Garhwal provinces, northern India).

Localities and stratigraphic range. Middle Kimeridgian to Middle (or Upper?) Tithonian.

Belemnopsis uhligi occurs in the Himalayas (Spiti and Niti regions) and Kachh in India, the Salt Range (Kalabagh) in West Pakistan, Indonesia (Timor, Roti, Sula Islands, Misol, Celebes, Buton), and the Central Highlands of New Guinea.

B. uhligi is present in the Ganjansar Beds (Middle Tithonian), which form the uppermost subdivision of the Katrol Series of the Jurassic succession in Kachh (see Nath 1932, p. 167; Holland *et al.* 1957, p. 86), and Spath (1927–33, pp. 662, 706) recorded *B.* cf. *uhligi* (as *B.* cf. *gerardi*) from the Umia Ammonite Beds (Upper Tithonian), immediately above the Ganjansar Beds. In the Himalayas *B. uhligi* occurs in the Lower and Middle Spiti Shales, the main occurrence being in the Lower Spiti. Arkell (1956, p. 407) has dated the Middle Spiti Shales (Chidamu Beds) as Lower Tithonian, but assigned an Upper Oxfordian age to the Lower Spiti Shales. In his dating of the Lower Spiti he was probably influenced by the agreement of previous workers on an Upper Oxfordian age for *B. uhligi* (i.e. *B. gerardi auctt.*) and by the work of Uhlig (1903–10) and Spath (1927–33), whose age determinations he quoted. Species closely related to *B. uhligi* first appear in the New Zealand belemnite succession in the late Middle Kimeridgian and *B. uhligi* probably appeared at the same time in the Indian succession.

Holland *et al.* (1957, p. 247) state that the Lower Spiti Shales are equivalent to the Kantkot Sandstone of the Kachh sequence, containing *B. gerardi* (= *B. kuntkotensis*), but their belemnite assemblages have nothing in common; *B. uhligi* appears to be absent in the latter and *B. gerardi* in the former. A possible explanation of this is that *B. uhligi* occurs only in the upper portion of the Lower Spiti Shales, and that this portion is not represented in the Kantkot Sandstone. So too *B. gerardi* may be restricted to the basal portion of the Kantkot Sandstone and this zone is not represented in the Lower Spiti Shales.

Stolley (1929) assigned an Upper Oxfordian age to the Indonesian *B. uhligi* and this age has been accepted by later workers (e.g. Wanner 1931; Wandel 1936; Teichert 1940; Vogler 1941; Glaessner 1945) though in later papers Stolley (1934, p. 473; 1935, p. 50) stated that *B. uhligi* may range into the Kimeridgian. Correlations between Indonesia and New Zealand may be established on the basis of their belemnites, *Buchia* and *Inoceramus*, and ages obtained from the ammonite sequence determined by Arkell in New Zealand (Fleming and Kear 1960). These have necessitated a revision of the ages commonly accepted for some of the Upper Jurassic guide fossils in the Indonesian and Australasian regions (Fleming 1960), including the Upper Oxfordian age for *B. uhligi* (*B. gerardi auctt.*). In Taliabu (Sula Islands, Indonesia) *B. uhligi* is associated with *Inoceramus galoi* Boehm, which is of Lower-Middle Kimeridgian age in New Zealand. In Misol *B. moluccana* (Boehm), a predecessor of *B. uhligi*, occurs in the Lilintá Marls (Stolley 1934), which have been correlated with the Middle Kimeridgian of New Zealand, and *B. uhligi* occurs in the Fatjet Shales, which have been correlated with Lower, and

probably Middle, Tithonian. In the Kuabgen Group of the Central Highlands of New Guinea (Glaessner 1945) *B. uhligi* occurs with *Buchia malayomaorica* (Krumbeck) and *Inoceramus sp.* resembling *I. haasti* Hochst., *I. subhaasti* Wandel and *I. galoi* Boehm, which in New Zealand indicate Lower–Middle Kimeridgian. In New Zealand species closely related to *B. uhligi* first appear in the late Middle Kimeridgian, and the occurrences of *B. uhligi* in New Guinea and Taliabu mentioned above are thought to be of a similar age. To sum up, *B. uhligi* probably appeared in the Middle Kimeridgian and ranged through to at least Middle or Upper Tithonian.

In northern India, Indonesia, and New Guinea *B. uhligi* is associated with a number of allied species (the '*gerardi* group' of Uhlig, Spath, Stolley, &c.) which range into Australia and New Zealand, Iran, Arabia, and East Africa. These allied species differ from *B. uhligi* in characters such as degree of elongation and hastation, nature of apex and cross-sections of the guard. They will be described in a forthcoming publication (Stevens, in press).

Migrations of *Hibolithes* temporarily replaced *Belemnopsis uhligi* and allied species in Indonesia and New Zealand during parts of Middle Kimeridgian and Lower Tithonian time. The *Belemnopsis uhligi* group was finally replaced throughout the Indo-Pacific by migrations of *Hibolithes* and *Duvalia* in Upper Tithonian and Neocomian times.

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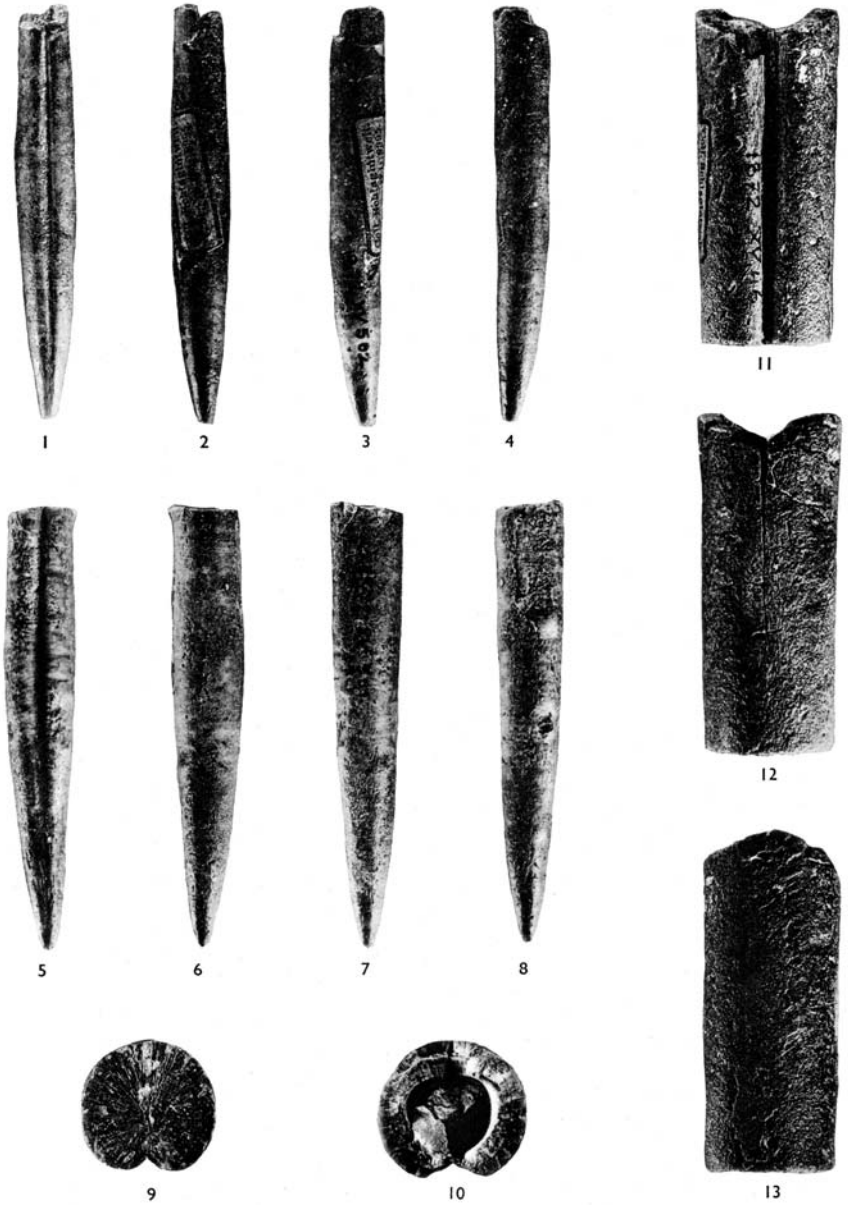
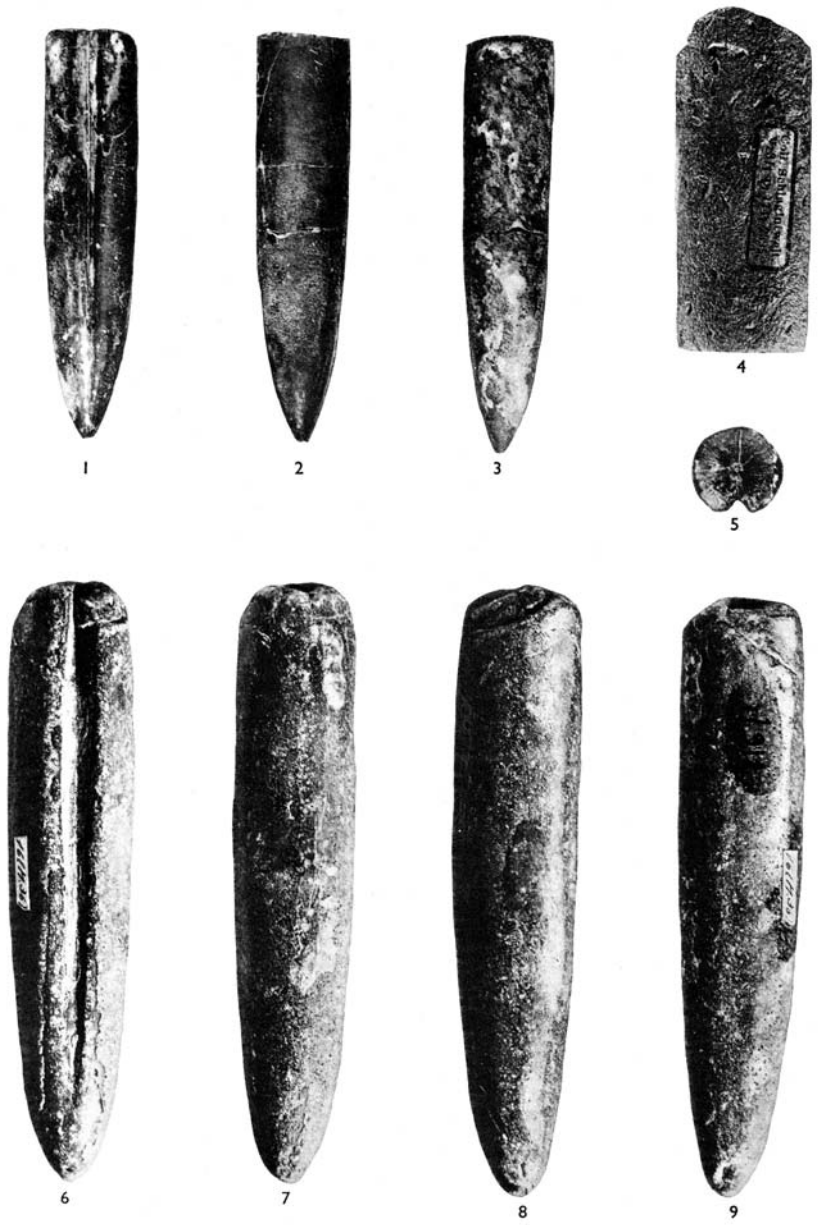


STEVENS, *Belemnopsis*



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