

Reprinted from

PROCEEDINGS OF THE
GEOLOGICAL SOCIETY OF LONDON

18 April 1962

SHORT COMMUNICATION

THE AMMONITES OF THE SPILSBY SANDSTONE, AND THE
JURASSIC-CRETACEOUS BOUNDARY

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In Lincolnshire the Kimmeridge Clay is succeeded unconformably by the Spilsby Sandstone, which has long been accepted as marking the base of the British marine Cretaceous. Recent finds in the Sandringham Sands of Norfolk (Casey 1961A) led to a routine examination of the Spilsby ammonite succession. The results were unexpected and alter the whole concept of ammonite chronology, correlation, and palaeogeography at the Jurassic-Cretaceous boundary in the Boreal province. In terms of the Russian sequence the Spilsby Sandstone must now be regarded as spanning the top of the Lower Volgian, Upper Volgian, and Riasan Beds. Its correlatives in Southern England extend from the upper part of the Portland Beds to the basal part of the Hastings Sands. The Jurassic-Cretaceous boundary thus runs through the middle of the formation. The idea that separately evolving ammonite communities were isolated by shrinkage of the oceans at the end of the Jurassic and the beginning of

the Cretaceous (cf. Salfeld 1921), already rejected in the case of *Hectoroceras* (Casey 1961b, p. 168), must be reconsidered in its application to the Volgian. We can no longer assume that the Jurassic seas with their ammonites retreated from north-west Europe with the end of the Portlandian (Arkell 1956, pp. 90, 612); the inference is clear that the Spilsby Sandstone, with its Volgian fauna, is in part a marine equivalent of the Purbeck Beds. It is even possible that the quasi-marine episodes of the British Purbeck, usually pictured as invasions from the south, represent incursions of the Spilsby sea through a gap in the Palaeozoic ridge north of Aylesbury.

	MOSCOW BASIN		ENGLAND		
	STAGES	ZONES	SPATH, 1924, 1936	PROPOSED REVISION	
CRETACEOUS	BERRIASIAN	Riasan Beds	SPILSBY SANDSTONE	HASTINGS SANDS (parts)	
		Surites stenomphalus Surites spasskensis			
JURASSIC	UPPER VOLGIAN	Riasanites rjasanensis	NO MARINE DEPOSITS IN BRITAIN	PURBECK BEDS	
		Craspedites nodiger			
		Craspedites subditus			
		Kachpurites fulgens			
	LOWER VOLGIAN	Lomonossovella blakei		GAP IN LINCOLNSHIRE	PORTLAND BEDS
		Epivirgatites nikitini			
		Virgatites virgatus			
		Zaraiskites scythicus			
		Dorsoplanites dorsoplanus			
	PORTLAND BEDS	KIMMERIDGE CLAY			

Similar conclusions on the correlation of the Spilsby Sandstone were reached by Pavlow (1889, 1892, 1896) but with few exceptions (e.g., Woodward 1895, Lamplugh 1896) British geologists were reluctant to concede any part of this sandstone to the Jurassic. Spath (1924A) dismissed Pavlow's (1892) determination of the Volgian ammonite *Craspedites* from this formation and asserted that the Spilsby ammonites belong

to a group found in the Lower Cretaceous of Russia. He proposed the name *Subcraspedites* for this group of ammonites and introduced the term 'Subcraspeditan Age' for the upper half of the Infra-Valanginian [Berriasian] Stage of the Cretaceous. This position was reaffirmed with the discovery of ammonites near the base of the Spilsby Sandstone in the Fordington well, north of Spilsby, Lincolnshire (Swinnerton 1935). Although some of these had a Jurassic appearance and were so distinct from anything seen previously in the Berriasian as to need a new generic name (*Paracraspedites* Swinnerton), their association with *Subcraspedites* was taken to confirm the Cretaceous age of the assemblage (Swinnerton 1935, Spath 1935, 1952). Berriasian occurrences of *Subcraspedites* have since been reported in Greenland, Spitsbergen, Novaya Zemlya (Spath 1936, 1947, 1952), and the Canadian Arctic (Jeletzky 1958), and of *Paracraspedites* in Greenland (Spath 1947, 1952; Donovan 1957), the Moscow basin, west Siberia, and Transcaspiia (Arkell 1957, Luppov & Drushchitz 1958). These two genera have now become the main supports of our present scheme of zonation and correlation within the Cretaceous basement rocks of the Boreal province.

The following comments on the ammonites are offered pending fuller discussion and illustration of the evidence:

(1) *Paracraspedites* (type-species *P. stenomphaloides* Swinnerton) is not a Craspeditid nor of Cretaceous age. It is a Portlandian-type Pavloviid close to *Titanites*. The validity of the genus and its exact position in the sequence in southern England may not be known until the ammonites of the Portland Beds have been studied systematically. Possibly the name will fall as a synonym of one of the many generic appellations Buckman coined for the Portland 'giants'. None of the foreign citations of the genus will survive close scrutiny.

(2) Specimens of the Portlandian genera *Kerberites* and *Orendonites* found in the condensed basement-bed of the Spilsby Sandstone at Nettleton Mine, Caistor, Lincolnshire, and hitherto regarded as derived fossils (Spath 1947) are native to the bed and not very different in age from *Paracraspedites*, with which they are associated (C. W. Wright and E. V. Wright coll.) (cf. Lamplugh 1896, p. 195).

(3) *Subcraspedites* is also a Jurassic genus, overlapping in the lower part of its range with *Paracraspedites* and appearing earlier, not later, than *Craspedites*. All the stratigraphically localized specimens examined from the Spilsby region were obtained from the lower six feet of the formation (e.g., Partney road-cutting, B.M., N.U.¹). Records of '*S.*' *subpressulus* (Bogoslowsky) in the lower part of the Spilsby Sandstone (Swinnerton 1935) and of *S. sowerbyi* Spath and '*S.*' *plicomphalus* (J. Sowerby) in association with '*S.*' *stenomphalus* (Pavlow) in the upper part (Spath 1952, Wright in Donovan 1957) are not confirmed. It is generally believed that the source-publication for the nominal genus *Subcraspedites* is Spath's paper on the Blake Collection from Kachh (Spath 1924b) and that the type-species is *A. plicomphalus* J. Sowerby. The name was in fact used in

¹ Repositories of specimens are indicated thus: B.M., British Museum (Natural History); G.S.M., Geological Survey and Museum; S.M., Sedgwick Museum, Cambridge; N.U., Geology Department, Nottingham University.

two earlier papers (Spath 1923, 1924A); the question of a type-species is too involved a problem to be dealt with here. Application will be made to the International Commission on Zoological Nomenclature to stabilize current taxonomic usage by designating *S. sowerbyi* Spath (= *A. plicomphalus* J. de C. Sow. 1823, non J. Sow. 1822) as type-species of *Subcraspedites*.

(4) *Craspedites* was correctly identified from the lower part of the Spilsby Sandstone by Pavlow (1892, 1896). *Craspedites* of the group of *C. subditus* (Trautschold) and a form comparable with *C. okensis* (d'Orbigny) have been collected from about ten feet above the base at Goulceby, Lincolnshire (G.S.M. 100512-3: R. G. Thurrell coll.). *Ammonites plicomphalus* J. Sowerby is a species of *Craspedites* close to *C. nodiger* (Eichwald); its horizon at Old Bolingbroke, Lincolnshire, is thought to lie some thirty feet above the base of the Sandstone (cf. Swinnerton coll., N.U.).

(5) Ammonites from the Upper Riasan Beds of Russia hitherto referred to *Subcraspedites* and *Paracraspedites* belong elsewhere. I would assign '*P.*' *spasskensis* (Nikitin), '*P.*' *kozakowianus* (Bogoslowsky), '*P.*' *tzikwianianus* (Bog.), and '*S.*' *suprasubditus* (Bog.) to the genus *Surites* Sazonov 1951 (type-species *S. pechorensis* Sazonov). '*Subcraspedites*' *pressulus* (Bog.) and '*S.*' *subpressulus* (Bog.) may be accommodated in *Tollia* Pavlow 1913. These two Cretaceous genera are closely allied and differ from *Subcraspedites* in the development of the primary ribbing, in the forward bend of the ribs on the venter, and in details of suture-line.

(6) *Subcraspedites groenlandicus* Spath from Milne Land, East Greenland, the only other place where *Subcraspedites* has been recorded as occurring above *Craspedites* (Spath 1936), is shown by its ribbing, suture-line, and smooth body-chamber (cf. B.M. C 52956) to belong to the Cretaceous genus *Tollia*. The only Arctic record of *Subcraspedites* that can be substantiated is that of *S.* aff. *preplicomphalus* Swinnerton from bed 6a in Laugeites Ravine, south-western Kuhn Island (Spath 1952). This is accompanied in the same hand-specimen by a species of *Laugeites*, a genus characteristic of the Lower Volgian of Russia. In order to explain the presence of a Jurassic ammonite side by side with a supposed Cretaceous one Spath assumed that all the ammonites in this bed were derived. Donovan (1957, p. 143) found it impossible from field observations to accept this explanation and suggested instead that *Laugeites* may be a long-ranging genus. Luppov & Drushchitz (1958, p. 90) give the range of *Laugeites* as the upper part of the Lower Volgian and the lower part of the Upper Volgian.

(7) Ammonites from the upper part of the Spilsby Sandstone hitherto referred to *Subcraspedites* should be assigned to *Surites* or to *Tollia*. *Surites* cf. *spasskensis* was collected by Dr. Thurrell from a nodule-bed in the middle of the Spilsby Sandstone at Wineby, Lincolnshire (G.S.M. 10015). Ammonites recorded from the higher levels of the formation in the Fordington well (Swinnerton 1941) comprise *Surites* sp. from a depth of 209 feet and *Surites* cf. *stenomphalus* (Pavlow), *Tollia subpressulus* (Bog.), and *T.* cf. *bidevera* (Bog.) from between 194 and 196 feet. The

original English '*Olcostephanus*' *stenomphalus* of Pavlow (1889, p. 59, pl. iii, fig. 1, S.M. B 11111, here designated lectotype) was obtained from the upper part of the Spilsby Sandstone at Donnington, Lincolnshire (Pavlow 1896, table).

The topmost Jurassic Zone of *Riasanites riasanensis* (= Lower Riasan Beds) has not yet been proved in Lincolnshire, though there is room for it just below the middle of the Spilsby Sandstone; no ammonites are at present available from this level. The Cretaceous portion of the succession, corresponding to the Upper Riasan Beds, is well developed in the southern part of the Lincolnshire Wolds; its occurrence as far north as Nettleton Mine is uncertain. That this period of Jurassic and Cretaceous time is represented in Lincolnshire by at most eighty feet of strata is of no consequence considering that the equivalent beds in the Moscow Basin are in places less than twenty feet thick. During the same interval possibly five hundred to eight hundred feet of sediment were laid down in southern England.

With the exception of *Laugeites*, a specialized form perhaps transitional to the Craspeditidae, the Pavloviidae are believed to have died out with the close of the Lower Volgian. The overlap of *Subcraspedites* with Pavloviids in the Spilsby Sandstone and the occurrence of this genus immediately below *Craspedites*, which in Russia characterizes the Upper Volgian, are thus important. The links with Portlandian and Volgian faunas referred to above make Spath's (1936) view that the Volgian stage is wholly post-Portlandian untenable. It seems that Nikitin (1889) and others were essentially right in correlating the Volgian with the Hartwell Clay, Portland Beds, and Purbeck Beds of southern England. Nikitin's opinions were shaped partly by study of material in the Geological Survey and Museum. That he had identified correctly the Lower Volgian ammonite *Lomonossovella lomonosovi* (Vishniakoff) (or a very closely allied species) in the Portland Beds [Cockly Bed] of Swindon, Wiltshire (cf. G.S.M. 49715) appears to have been overlooked.

Besides material in the Geological Survey and Museum (which includes Russian Volgian cephalopods presented by Professor A. Pavlow), Spilsby, Volgian, and Greenland fossils have been made available to me through the courtesy of Dr. M. K. Howarth and Mr. D. Phillips (British Museum, Natural History), Mr. A. G. Brighton (Sedgwick Museum), Dr. D. T. Donovan (Bristol University), Prof. W. D. Evans and Mr. A. Honeyman (Nottingham University), and Mr. C. W. Wright. Information has been kindly given on Greenland occurrences by Dr. D. T. Donovan and on the Spilsby Sandstone by Professor H. H. Swinnerton and Dr. R. G. Thurrell. This communication is published with the permission of the Director, Geological Survey and Museum of Practical Geology.

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