ON THE AGE OF THE CHIKKIM SERIES*

G. KOHLI and V. V. SASTRI

Geological Survey of India

ABSTRACT—In the summer of 1952 G. Kohli and B. N. Shukla of the Geological Survey of India crossed over the Great Himalaya Range into the Spiti valley to study the Tethys sediments. From the Cretaceous Chikkim series of this area the important index fossil *Globotruncana* was collected for the first time. The determination of this genus establishes the age of this series as Cenomanian to the Senonian. The presence of an Upper Cretaceous sea as far south as the Spiti valley is thus also established.

INTRODUCTION

IN the absence of any fossils of diagnostic value, the age of the Chikkim series has remained doubtful ever since F. Stoliczka (1866) indicated the presence of the Cretaceous sediments in the Himalayas, almost a century ago. The expedition consisting of the senior author and Mr. B. N. Shukla collected material from the Chikkim series, examination of which has revealed the presence of the important foraminiferal genus *Globotruncana*, which is being reported for the first time from this series; and, as far as the authors are aware, it has not so far been reported elsewhere from the Himalayas. §

The determination of this genus, permits of the series being referred to the narrow limits of standard stages. In view of this, we are publishing this short paper embodying the more important conclusions in advance of a more detailed account which will appear at a later date.

GEOGRAPHIC LOCATION OF THE AREA

The Spiti valley lies across the Great Himalaya Range between the latitudes 31°-47′ and 32°-34′ and the longitudes 77°-40′ and 78°-40′. The section studied was the southern limb of a complicated synclinal outlier near the Survey of India Chikkim station (32°-21′ : 77°-59′). This synclinal outlier is also the type section for the Chikkim series (Plate 32).

GEOLOGY

The Chikkim series overlie the Gieumal† sandstone. Field evidence suggests that there was a minor cessation of sedimentation after the deposition of the Gieumals. The Chikkim limestone forms a scarp in this section, attaining a true thickness of aproximately 100 feet. It is a light grey, massive, fine-grained foraminiferal limestone. The bed immediately underlying the Chikkim limestone is a calcareous quartzite, commonly containing belemnites. This bed was seen to thin eastwards from 34 inches to 19 inches in a distance of about 200 yards over which it was examined. The base of the Chikkim limestone, locally in this section also contains belemnites but they are not so frequent as in the quartzite bed. At the top of the massive (main) limestone is a $1\frac{1}{2}$ feet thick bed, which is mottled and weathers rubbly. It is this and the higher beds which commonly contain the previously reported foraminifera, such as *Nodosaria*, *Cristellaria* and *Textularia*. The main limestone contains microforaminifera. A small thickness of shaly beds with intercalations of thin limestone bands overlying the main limestone has been taken as the passage beds and these grade into the Chikkim shales.

The grey-green Chikkim shales occupy the core of this complicated synclinal outlier. These shales are calcareous and somewhat sandy, especially the lower members. The shales are too intricately folded to permit of stratigraphic measurement, but Hayden

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§We understand that our colleague Mr. B. S. Jangpangi has, subsequent to our describing the material under report, found *Globotruncana* from the Cretaceous of Koigar region.

†Original spelling (Stoliczka 1866) has been retained.

(1904) who examined them elsewhere concluded that their thickness could not be less than 150 feet.

PREVIOUS WORK

Space does not permit us to review previous literature except for a brief mention of A. Spitz's (1914) important paper on 'A Lower Cretaceous fauna from the Himalayan Gieumal Sandstone, together with a description of a few fossils from the Chikkim Series'; Spitz re-examined the existing collections from the Chikkims and recorded the following foraminifera besides fragments of *Rudistes* and two specimens of belemnites: *Nodosaria* 4 species, *Cristellaria* 3 species, *Textularia* sps. and Globigerinae. Remarking on the foraminiferal assemblage Spitz concluded that 'they are of no stratigraphic value but may be of assistance locally in case of any further geological examination of the area.'

AGE OF THE CHIKKIM SERIES

An Upper Cretaceous age for the Chikkim series has been deduced by some workers, based on the evidence of fragments of *Rudistes* found in the Chikkim limestone, or on indirect evidence i.e. from the age of the underlying Gieumal sandstone; but in the absence of fossils of stratigraphic value, their position within the Upper Cretaceous could not be established so far.

A preliminary study of the foraminiferal fauna of the Chikkim limestone (Plate 33) reveals that the age of the limestone sampled up to date, ranges from the Cenomanian to the Senonian (Campanian). The basal portion of the limestone contains *Globotruncana appenninica*, Renz, Globigerinae, *Anomalina* sp., etc. (slide Nos. 17682 (in part) and 17683). This fauna is easily distinguishable from that of the underlying Gieumal sandstone which comprises mostly of small Globigerinae and a few rotalids, (slide Nos. 17682 (in part). The middle portion of the Chikkim limestone, as seen in three slides, is found to contain *Globotruncana linneana* (d'Orb.), Globigerinae, *Anomalina* sp., *Bolivina* sp. etc., (slide Nos. 17684). The topmost horizon of the sampled portion of the limestone is highly foraminiferal, consisting of the following forms : *Textularia* sp., *Lenticulina* sp., *Dentalina* sp., *Nodosaria* sp., *Neoflabellina* sp., *Pseudotextularia* sp., Globigerinae, *Globotruncana linneana* (d'Orb.), *G. stuarti* (de Lapparent), *Anomalina* sp., *Planulina* sp., etc., (slide Nos. 17685, 17686, 17687, 17688 and 17689).

It is inferred from the above study that the Gieumal sandstone is of Lower Cretaceous age, the basal portion of the Chikkim limestone is Cenomanian, the middle is Turonian, and the top horizon as belonging to the Senonian (Campanian). The upper limit of the Chikkim limestone, as a whole, cannot be precisely stated at this stage.

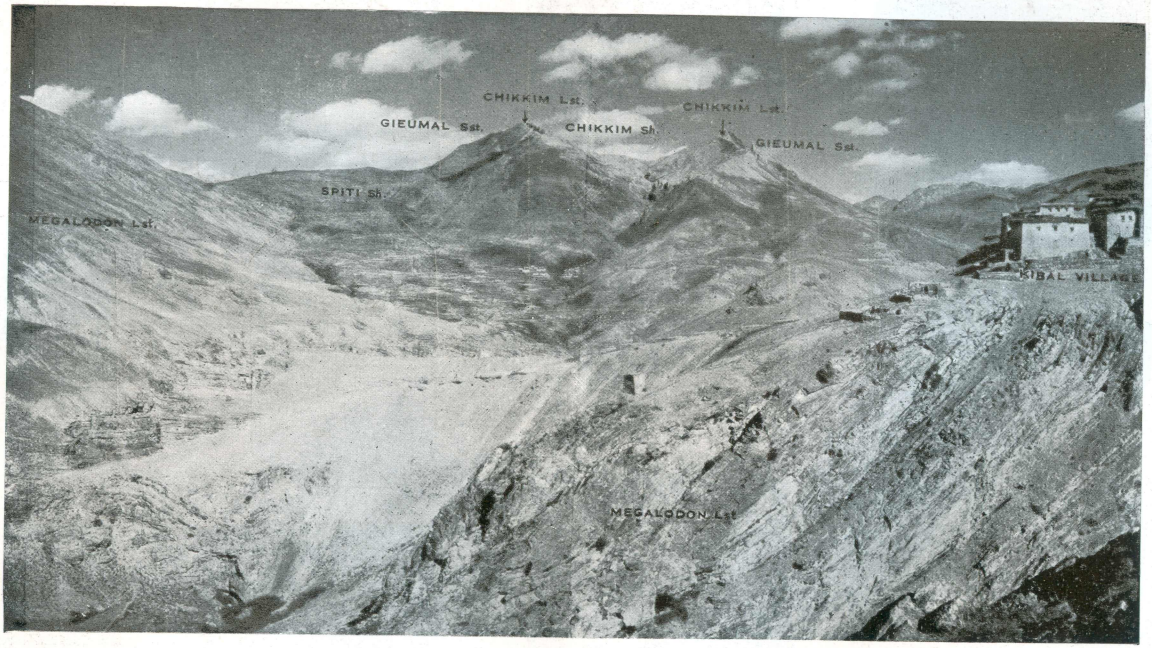
According to Burrard, Hayden and Heron (1933) "The Cenomanian is missing throughout the Himalaya [G. de P. Cotter : Records, Geological Survey of India, Vol. LIX, 405-409, (1927)], as throughout North-Western India, though well developed in Southern India." However, it is apparent from the foregoing study that an Upper Cretaeeous sea did extend atleast as far south as Spiti.

ACKNOWLEDGEMENTS

The authors are indebted to Dr. M. S. Krishnan, Director, Geological Survey of India, Dr. M. R. Sahni, Palaeontologist, Geological Survey of India and to Dr. K. Jacob, for many helpful suggestions. We are also grateful to Mr. B. N. Shukla for placing the material collected by him at our disposal for study.

EXPLANATION OF PLATE 32

Panoramic view from Kibar village (not Kibal, as in photograph) showing the complicated synclinal outlier of the Chikkim series, the limestone forming the scarp with the Chikkim shales occupying the core of the syncline. (Photo : G. Kohli).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GIEUMAL Sst.
CHIKKIM Sh.
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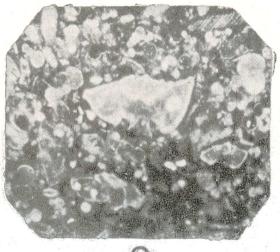
GIEUMAL Sst.
SPITI Sh.
MEGALODON Lst.
KIBAL VILLAGE
MEGALODON Lst.

1



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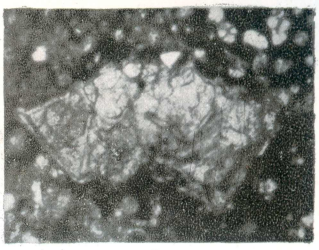

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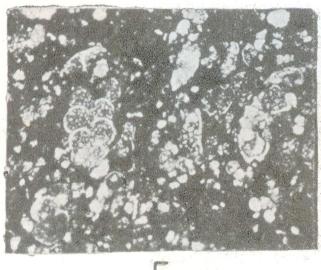

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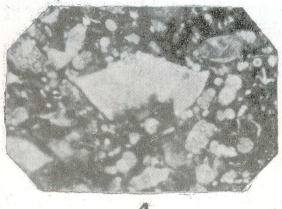

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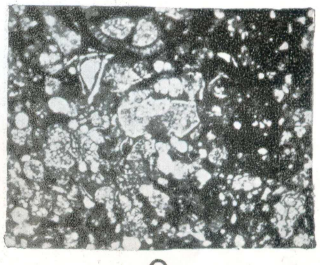

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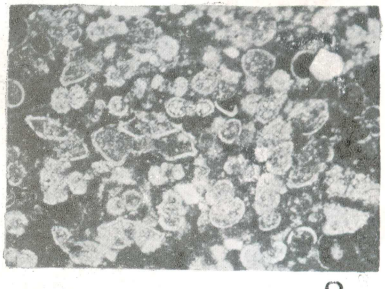

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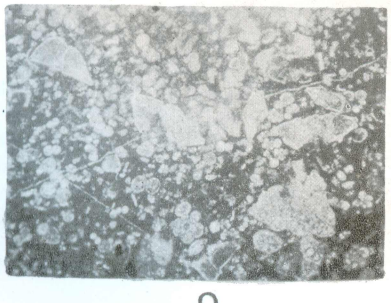

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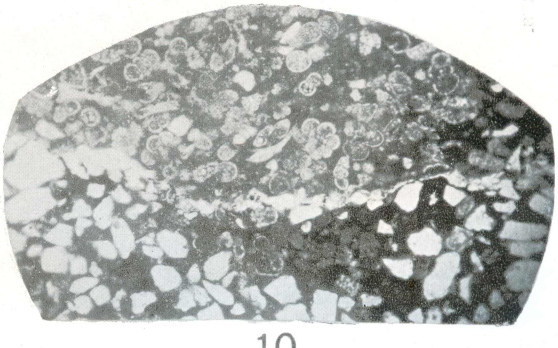

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EXPLANATION OF PLATE 33

Figs. 1—4 *Globotruncana stuarti* (de Lapparent) from the topmost horizon of the sampled portion of the Chikkim limestone. Fig. 1. ×82, G. S. I. Type slide No. 17685; Fig. 2. ×24, G.S.I. Type slide No. 17688; Fig. 3. ×55, G. S. I. Type slide No. 17686; Fig. 4. ×24, G.S.I. Type slide No. 17689.

5—6 *Pseudotextularia* sp., and *G. linneana* (d'Orb.) from the topmost horizon of the sampled portion of the Chikkim limestone. Fig. 5. ×28, G. S. I. Type slide No. 17687 ; Fig. 6. ×28, G. S. I. Type slide No. 17687.

7 *G. linneana* (d'Orb.) from the middle portion of the Chikkim limestone. ×32, G. S. I. Type slide No. 17684.

8—9 *G. appennininca* Renz and Globigerinae from the basal portion of the Chikkim limestone. Fig. 8. ×28, G. S. I. Type slide No. 17682 ; Fig. 9. ×20, G. S. I. Type slide No. 17683.

10 Photomicrograph showing the contact between the underlying quartzite and the Chikkim limestone. ×20, G. S. I. Type slide No. 17682.