3. Murty, M. V. R., *National Conference on Application of Remote Sensing*, 1983, p. 117.

ACKNOWLEDGEMENTS. I thank Dr P. K. Saraswati of the Department of Earth Sciences, for help. Thanks are due to DST, New Delhi, for financial support.

11 September 1989

Conoid shells (?*Tentaculites* sp.) from the Lipak Formation, Yulang Valley, Kinnaur Himalaya

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Conoid shells (?*Tentaculites*) suggesting an Upper Devonian age of Lipak Formation are being described from the Yulang Valley, Kinnaur Himalaya. Their parallel orientation suggests mild bottom currents in the shallow and warm Lipak lagoon.

CONOID shells attributable to *Tentaculites* sp. were recorded from the Lipak Formation (Kanawar Group). These fossils occur 12 m above the Muth–Lipak contact exposed about 1.5 km upstream of Yulang Dogri in the Yulang Valley (Figure 1*a* and *b*), Kinnaur district, Himachal Pradesh. The Lipak Formation had been assigned a Lower Carboniferous age due to the presence of *Syringothyris cuspidata*, *Phillipsia cliffordi* and *Helodus crenulatus*[1].

Conoid shells were recorded from a thinly-bedded dark wacke/packstone containing fragmentary brachiopods, ostracods, crinoids, echinids, bryozoans and trilobites. These occur along the bedding plane and exhibit parallel alignment (Figure 2*a*). The shells are slightly curved gradually tapering cones of variable length (15–25 mm) and apertural diameter (2–5 mm) and thick

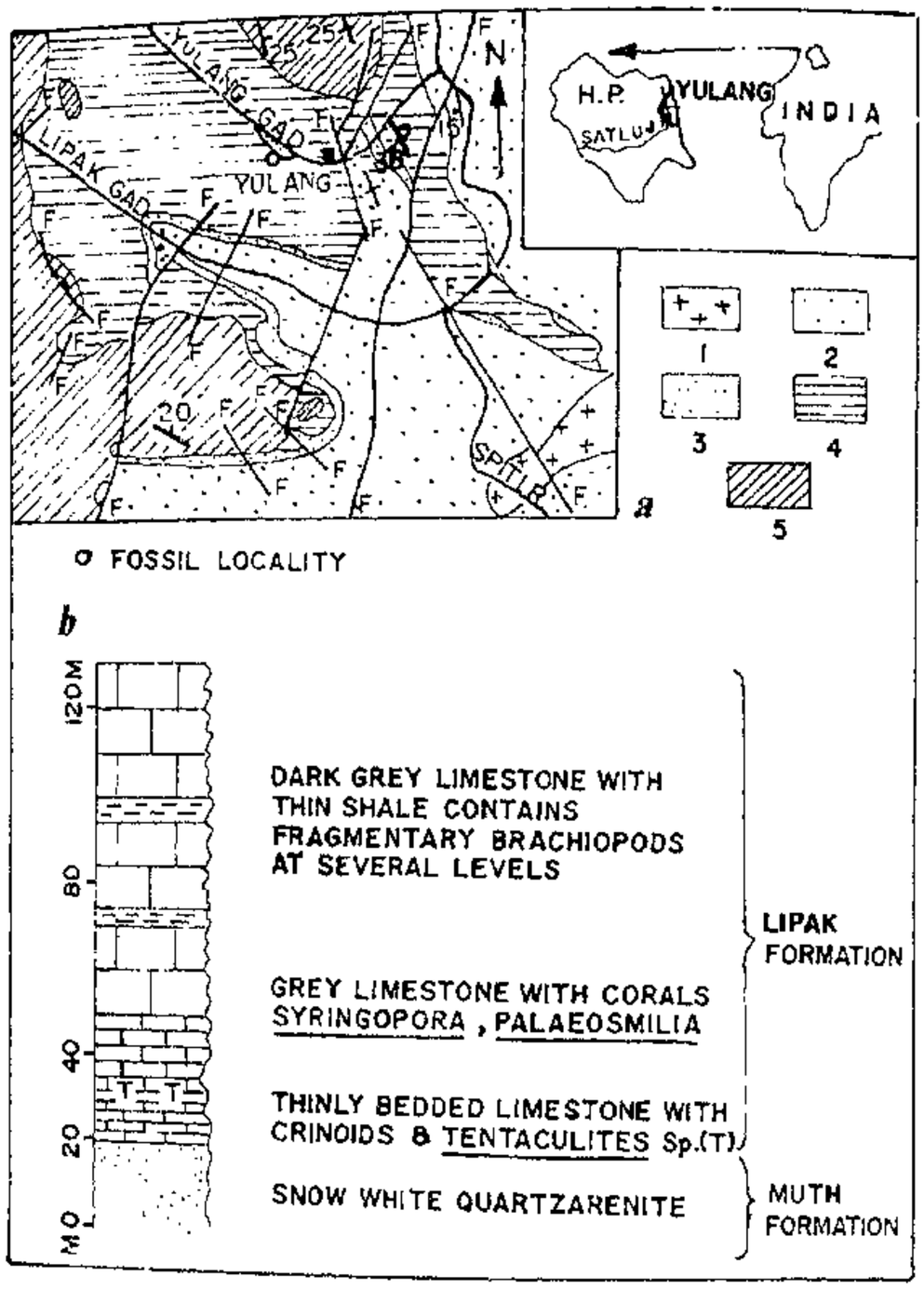

Figure 1. *a*, Geological map of the Yulang Valley; Kinnaur Himalaya along with location map (inset). Legend: 1. Granite, 2. Pre-Muth Sequence, 3. Muth Formation, 4. Lipak Formation, and 5. Post-Lipak sequence. *b*, Lithocolumn showing *Tentaculites* bearing horizon in the Yulang Valley, Kinnaur Himalaya.

shell (Figure 2*b*). The growth angles in the juvenile and adult forms are 10–12° and 7–8° respectively. The transverse ridges are poorly preserved (Figure 2*c*). The shells are filled with micritic material and fossil debris.

These conoid shells could be hyoliths, coleolids, dacryoconarids and tentaculites. They differ from hyoliths in not having bilateral symmetry, pyramidal shell and strongly projected aperture; from coleolids by

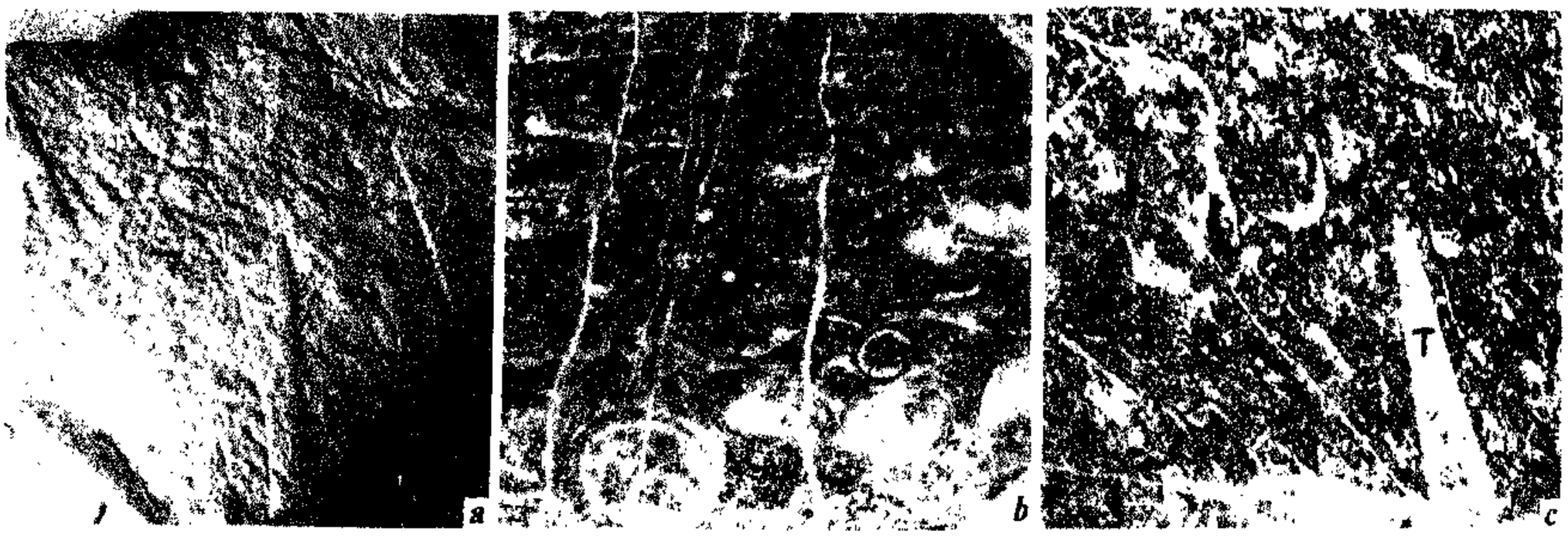

Figure 2. *a*, Oriented curved shells of *Tentaculites*, Yulang Valley, Kinnaur Himalaya (× 1); *b*, Transverse section of *Tentaculites* showing thick shell walls (× 4); *c*, Longitudinal section of *Tentaculites* showing faint transverse ridges (× 1).

the absence of tubuliform and extremely elongate shell and from dacryoconarids in lacking pronounced tear-drop bulb at the apex, thin shell, bilateral symmetry and larger growth angle. By elimination thus and also on the basis of apex shape, slightly curved shell with faint transverse ridges, thick shell wall, size and growth angles[2], these are found comparable with *Tentaculites.*

The *Tentaculites* have a stratigraphic range from Silurian to Devonian[2]. Its presence in the basal part with conformable sequence right up to Carboniferous fossil bearing beds[1], suggests that the basal part of the Lipak Formation represents a Devonian age—possibly Upper Devonian. Such an age assignment is apparently supported by the record of late Devonian brachiopods, conodonts and fish remains from the Lower Lipak limestone of this very section[3–5]. However, the lithology immediately overlying the Muth Formation described in the above cited publications (50 m shale[3] and 10 m grey limestone[4]) is contradictory and the veracity of the fossils described therein has been questioned[6].

Tentaculites are exclusively marine and prolific in shallow lagoons. These are regarded as nektonic to benthonic scavengers in relatively warmer, more agitated waters. Lagoonal, shallow and warm environments are also suggested by the presence of corals and gypsum in the Lipak Formation. Parallel orientation of *Tentaculites* cones suggests the presence of mild bottom currents in the Lipak lagoon.

1. Hayden, H. H., *Mem. Geol. Surv. India*, 1904, **36**, 1.
2. Fisher, D. W., *Treatise on Invertebrate Palaeontology* (ed. Moore, R. C.), University of Kansas Press, 1962, p. 98.
3. Gupta, V. J. and Janvier, Ph., *Bull. Indian Geol. Assoc.*, 1979, **12**, 161.
4. Gupta, V. J. and Struve, W., *Bull. Indian Geol. Assoc.*, 1987, **20**, 25.
5. Gupta, V. J., *J. Geol. Soc. India*, 1987; **30**, 315.
6. Talent, J. A., Geol, R. K., Jain, A. K. and Pickett, J. W., *Courier, Forsch. -Inst. Senncken berg*, 1988, **106**, 1.

18 September 1989; revised 16 November 1989

Abundance of Jurassic bivalves during marine transgressive–regressive cyclic events

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Jurassic (Callovo–Oxfordian) rocks in Kachchh show evidence of marine transgressive–regressive events. The Oxfordian bed, deposited during the transgressive phase, is characterized by greater abundance of infaunal bivalves, while the Callovian beds, deposited during the regressive phase, show predominance of epifaunal bivalves.

THE present note concerns the study of the abundance of epifaunal–infaunal groups of bivalve during marine transgressive–regressive cyclic events from the Jurassic rocks of Kachchh, Gujarat. On the basis of data obtained from field, a graph (Figure 1) has been prepared showing the abundance of fauna during Callovo–Oxfordian time.

During Callovo–Oxfordian age, a large-scale deposition of the sediment took place in the Kachchh basin as a result of marine transgressive–regressive cyclic events. The characteristic bed, 'Dhosa Oolite' (Oxfordian) comprises of small thickness throughout the Kachchh which has been deposited during the transgressive phase, whereas the Callovian beds, which constitute huge deposition of shale over sandstone beds are supposed to have been deposited during the regressive phase[1].

The rate of supply of terrigenous sediments has a direct relationship with the thickness of the deposition, i.e. with increase in the terrigenous sediments the thickness of the strata also increases and vice-versa. Such a variation in the rate of supply of terrigenous sediments has also influenced the basin environment. The shallowing of the basin is favoured by an increase in the rate of supply of terrigenous sediments (during regression) while the reduced supply of the terrigenous sediments in the basin (during transgression) suggests deepening of the basin.

In the modern ocean life context, the epifaunal bivalves are more abundant in the shallow regions of the sea, whereas the infaunal bivalves are predominant at greater depths[2]. The above argument of Hedgpeth agrees well with our graph in which abundance of three

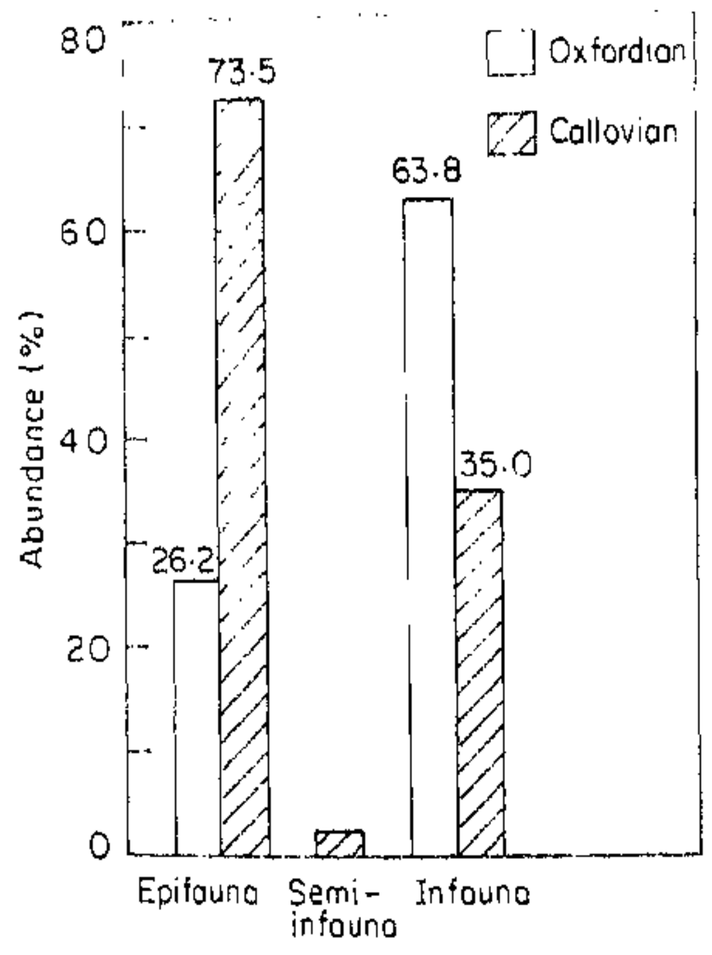

Figure 1. Relative abundance of fauna in Callovo-Oxfordian time.