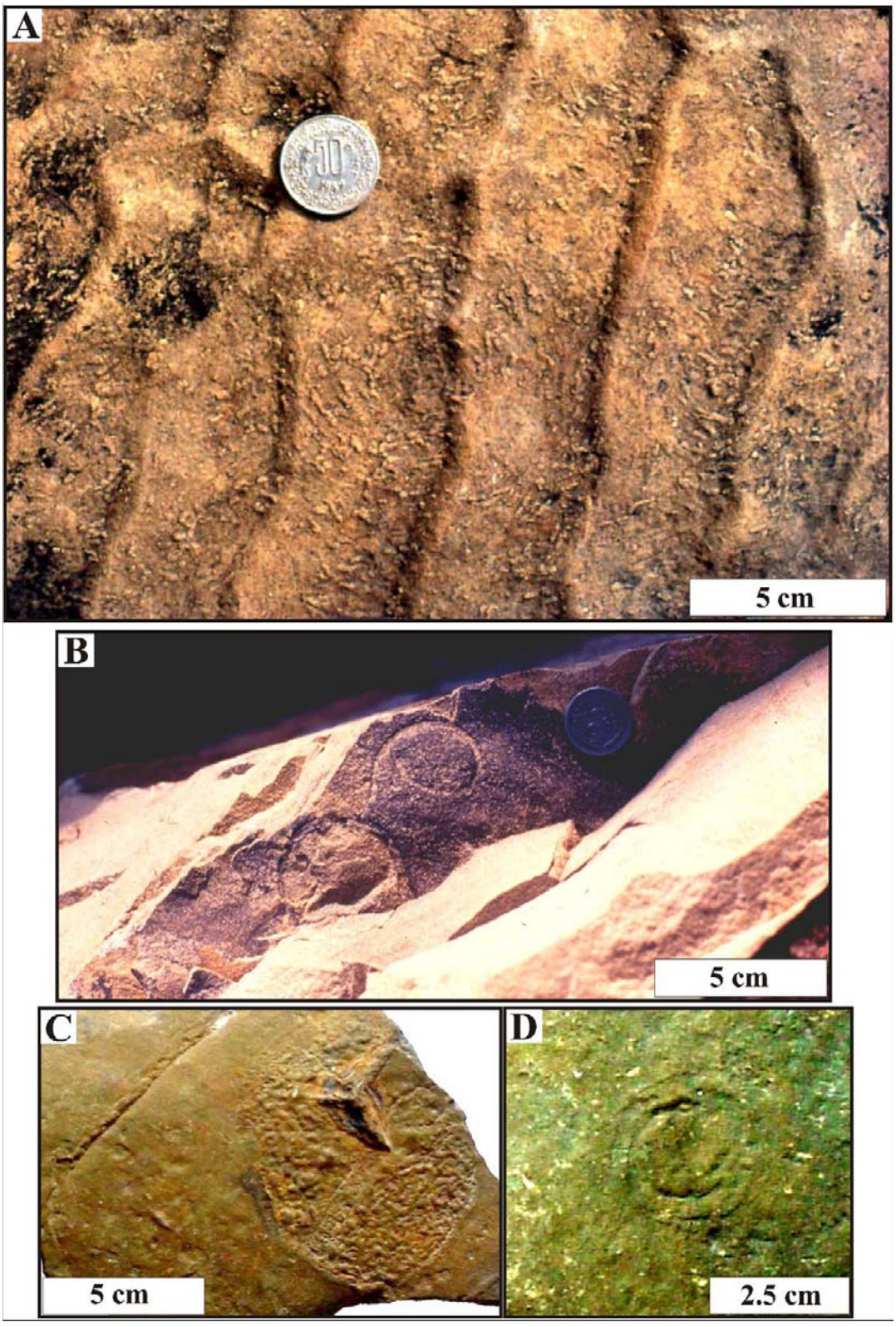
6(b). Some unusual and/or problematic inferred mat-related features

S. Sarkar and S. Banerjee

One may encounter from time to time structures that are more difficult than others to interpret in genetic terms, structures that may have some characteristics in common with identified or inferred mat structures, but not all. Some of these problematic structures which are preserved in Meso- to Neoproterozoic sandstones of the Vindhyan Supergroup in India are illustrated in Figure 6(b)-1. Discussion of their possible genesis is briefly outlined in the relevant captions.

In: *Atlas of microbial mat features preserved within the clastic rock record,* Schieber, J., Bose, P.K., Eriksson, P.G., Banerjee, S., Sarkar, S., Altermann, W., and Catuneau, O., (Eds.)J. Schieber et al. (Eds.), Elsevier, p. 145-147. (2007)

Figures



In: *Atlas of microbial mat features preserved within the clastic rock record,* Schieber, J., Bose, P.K., Eriksson, P.G., Banerjee, S., Sarkar, S., Altermann, W., and Catuneau, O., (Eds.)J. Schieber et al. (Eds.), Elsevier, p. 145-147. (2007)

Figure 6(b)-1: Unusual and/or problematic features preserved inMeso- to Neoproterozoic Vindhyan Supergroup sandstones, India.
(A) Concentrically/spirally arranged elongated beads. *Description*: The structure is made up of small elongated beads of sand arranged in close concentric rims or spires, the exact pattern being indeterminable because of local obliterations. Some of the beads, however, defy this profound arrangement. Individual beads are spindle-shaped and of average length 3.2 mm, width 1.3 mm and height 1 mm. End-to-end coalescence between adjacent beads gives rise to wrinkled thread-like shapes of maximum measured length 5.2 mm. Otherwise the beads maintain a fair degree of uniformity in length, width and height. In the example illustrated these concentrically or spirally arranged bead-like structures are present in the form of a crowded colony on a wave-rippled sandstone. The best preserved overall disc-shaped colonial structure has a diameter of ca. 9 cm (coin diameter 2.5 cm). *Interpretation*: An origin without influence of biota, no matter whether unicellular or multicellular, cannot possibly be conceived for this structure. Though the structure shown here is from the Chorhat Sandstone, India (see Figure 7(d)-1) and may thus be as old as 1.6 Ga (Rasmussen et al., 2002) the influence of a multicellular organism on its origin cannot be ruled out in the light of the discovery of possible undermat burrows of a triploblastic organism, within the same formation (Seilacher et al., 1998). If the structure is, indeed, planispiral, one can interpret the minute elongated beads of roughly the same width and height as faecal pellets of a sediment- or mat-ingesting worm that scanned the rippled surface closely for food. A serious snag in this interpretation is the absolutely intact preservation of the ripples immediately underlying them. The putative animal track should have left some trace on the ripple crests, but then the organism could have restricted its movement on the mat protecting the ripples. On the other hand, concentric arrangements of minute pinnacles are generated on modern microbial mats possibly because of ring-like propagation of growth fronts of chemotactic bacteria releasing recurrent pulses of chemical compounds in response to their concentration gradients. However, till we know what indeed controlled the distribution and the profound circular arrangement of the spindle-shaped beads (or short wrinkles), genesis of the structure remains ambiguous. *Location*: The example shown comes from the upper part of the 1.6 Ga Chorhat Sandstone of the Vindhyan Supergroup, 2 km west–southwest of the town of Chorhat, India (see Chapter 7(d)). Palaeogeography: upper shoreface. (B) Spire-shaped tubular structure. *Description*: A spiral tube of diameter about 1.7 mm, partially exhumed on a sandstone bed surface (centre of photo). *Interpretation*: The structure appears as a horizontal burrow resembling *Planispiralichnus* of Fedonkin (1990), but this particular structure is more likely to be a synaeresis crack whose opposite tips closed upon the crack's fill of younger sand. *Location*: Documentation was made from the base of the 1.6 Ga Chorhat Sandstone exposed 1.5 km southwest of the town of Chorhat (see Chapter 7(d)). Palaeoenvironment: top of a fluvial mid-channel bar. (C) Roughly circular object bearing wrinkles and triradiate furrows (now seen in reverse as ridges) at the centre. *Description*: Reverse impression of a roughly circular wrinkled structure having three furrows radiating from the centre, but not reaching the periphery, at the sole of a sandstone bed. *Interpretation*: The wrinkled mass is similar to the frills of the objects described as mat structures in Figure 7(d)-4A, having the wrinkle ridges broadly in two sets at a high angle to each other. The wrinkles suggest a soft gelatinous sheet-like nature, as would be likely for a microbial mat. However, the central triangular symmetry expressed in the furrows suggests this is an impression of an animal-like cniderin or precursor of echinodermata. *Location*: Documentation comes from the Neoproterozoic Sirbu Shale (Figure 7(d)-1), Vindhyan Supergroup at Uchaihra, India. Palaeogeography: mid-shelf area, but the object, imprinted at the base of a storm sandstone bed, might have been transported from a shallower part of the Sirbu shelf. (D) Circular impression. *Description*: Circular impression of an object with diameter 2.6 cm and with concentric bands of average width 4.5 mm separated by thin ridges, now represented in reverse (sole marking) as furrows. The bands are presumably biogenic growth bands and ring-like structures do form in modern mats, involving growth dynamics with frequent polarity changes. Yet it is difficult to say whether these persistent bands around a circular central zone belong to unicellular or multicellular organisms. *Location*: Documentation was made from the base of a sandstone bed in the Sirbu Shale (Figure 7(d)-1), Vindhyan Supergroup at Uchaira, India. Palaeoenvironment: mid-shelf, but the object might have been derived from a shallower part of the Sirbu shelf. All photos: Subir Sarkar, Santanu Banerjee, Snehasis Chakraborty, Pradip Samanta.

In: *Atlas of microbial mat features preserved within the clastic rock record,* Schieber, J., Bose, P.K., Eriksson, P.G., Banerjee, S., Sarkar, S., Altermann, W., and Catuneau, O., (Eds.)J. Schieber et al. (Eds.), Elsevier, p. 145-147. (2007)

References

Fedonkin, M.A., 1990. Systematic description of Vendian Metazoa. In: Sokolov, B.S., Iwanowski, A.B. (Eds.), The Vendian System (vol. 1): Paleontology. Springer-Verlag, Berlin, pp. 71-120.

Rasmussen, B., Bose, P.K., Sarkar, S., Banerjee, S., Fletcher, I.R., Mc Naughton, N.J., 2002. 1.6 Ga U-Pb zircon ages for the Chorhat Sandstone, Lower Vindhyan, India: possible implication for early evolution of animals. Geology 30: 103-106.

Seilacher, A., Bose, P.K., Pfluger, F., 1998. Triploblastic animals more than 1 billion years ago: trace fossil evidence from India. Science 282: 80-83.