46th BIRBAL SAHNI MEMORIAL LECTURE

Conundrums, correlations, and applications: resolving the Cambrian and earlier stratigraphy of the Indian subcontinent and its broader geological utility

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Dating rocks using fossils remains one of the most important stratigraphic tools both for Phanerozoic sedimentary rocks and increasingly, for older rocks too. Inevitably situations arise in which different types of data offer seemingly contradictory indications of age, of which several examples from Cambrian and earlier rocks of Indian subcontinent. These examples highlight the main kinds of conundrums and their solution, their positive role in moving stratigraphic geology forward, and also a surprising way in which they are misused. The growth of geological knowledge
regionally and globally, along with the introduction of additional techniques for dating rock strata, means that the temporal range of the alternative explanations within particular conundrums tends to decline with time, although an important, controversy with alternatives over 1.0Ga apart, is currently active concerning Vindhyan geology. With respect to the later Neoproterozoic and Cambrian, our group has been working both in the Himalaya and on the craton to resolve stratigraphic correlations using both organic-walled and skeletonized fossils, along with other dating constraints, and particularly those provided by detrital zircon ages. This has been necessary because the Indian subcontinent's biota has been among the least well known of any Cambrian succession worldwide. Comprehensive revision of previously described type material and a substantial number of new finds have revealed a typical Cambrian biota. Regional biostratigraphic zonations for trilobites, brachiopods, small shelly fossils, and trace fossils let us build an integrated Cambrian biostratigraphic scheme that permits correlation along and across the lithotectonic zones of the Himalayan margin and southward onto cratonic India. Furthermore, the regional Cambrian can be correlated globally with reasonable precision, and all parts of the Himalayan margin south of the Yarlung-Tsangpo suture have a core equatorial Gondwanan biota, most similar to North China, and particularly, South China. These relationships help in the reconstruction of the form of the north Indian margin prior to the collision of India with Asia, and also constrain the nature of rocks that have been eroded since uplift began. This has implications for linking global changes in Cenozoic seawater chemistry to the most important single source of continentally-derived materials at the time: the erosion of the Himalaya. Thus, biostratigraphy remains of core significance both in determining the depositional ages of sedimentary rocks, but also when applied to other areas of geological and biological enquiry.
PROFILE

RESEARCH INTERESTS
Prof. Hughes’ research program aims, using field- and specimen-based analyses, to provide high-resolution data which addresses major questions of evolutionary mechanism in the early Phanerozoic. By utilizing the strengths of the trilobite fossil record, he attempts to dissect the detailed anatomy of the lower Paleozoic evolutionary radiations of trilobites, and to understand the relationship between patterns of morphological variability and phylogenetic ancestry. Other research interests include lower Paleozoic paleogeography and tectonics (particularly the early Paleozoic history of India and the peri-Gondwana region), shape restoration of deformed fossils, trace fossil paleobiology, and clastic sedimentology/striatigraphy.

EDUCATION
B.Sc. (Honors): University of Durham, U.K., Geology, 1982-1985
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EMPLOYMENT
Research Associate, Department of Paleobiology, Smithsonian Institution. 1994 - 1997.
Adjunct Assistant Professor, University of Cincinnati, U.S.A. December 1993 - 1997.
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