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Original article

Ammonites of the subfamily Mayaitinae Spath, 1928 from the Oxfordian of Kachchh, Western India☆

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ABSTRACT

A collection of 100 ammonites of the subfamily Mayaitinae Spath, 1928 (Sphaeroceratidae, Stephanocerataceae) from the Oxfordian (Upper Jurassic) of the Kachchh Basin, Western India, represents 19 morphospecies. Their study confirms most of the species originally described from the Kachchh Basin more than 80 years ago, but it strongly extends the knowledge on their diagnostic features. Most species can be readily differentiated by the shape and ontogenetic development of their whorl section as illustrated by a Fourier shape analysis. The Oxfordian subfamily Mayaitinae is largely endemic to the Malagasy Gulf and adjacent regions at the southern margin of the Tethys. Finds of isolated specimens from other areas of the northern Tethys or southern Pacific are suggested to be drifted shells or misinterpretations of homeomorphic taxa. Although commonly found in the Kachchh Basin, the group has received little attention through the last decades due to their seemingly limited use in biostratigraphy. In the present study the biostratigraphic potential of a series of taxa is discussed; e.g., *Epimayaites subtumidus* seems to be restricted to the Stenocycloides Subzone (Bifurcatus Zone) of the Upper Oxfordian.

1. Introduction

The Jurassic succession of the Kachchh Basin in Western India has been studied for more than a century, beginning with surveys of Sykes (1834), Grant (1837), Blanford (1869), and Wynne (1872). Subsequently, scientists started to examine and describe the rich and well preserved fossil content of the rocks, especially of the Jurassic part of the succession. Taxonomic monographs were published on different fossil groups, but particularly the cephalopods were studied in detail due to their diversity, abundance, and most importantly their significance for stratigraphic correlations. Particularly outstanding are the works of Waagen (1873-1875) and Spath (1927-1933), which are still used today as a basis for the identification of cephalopods from the basin. With continuation of geological and palaeontological research in the Kachchh Basin the lithostratigraphic framework and ammonite biostratigraphy are now much better understood (Fürsich et al., 2013). Four recent field surveys in the Kachchh Basin, however, which concentrated mainly on the Oxfordian part of the succession, yielded more than 800 ammonoids and showed that the fossil record of this group is still not fully known. In addition, a modern and comprehensive taxonomic study of the Jurassic ammonite fauna based on material collected with a high stratigraphic resolution is not yet available. The present study is one in a series to enlarge our knowledge of the Upper Jurassic cephalopods of the Kachchh Basin (see Alberti et al., 2011; Pandey et al., 2012a, 2013a, 2013b, 2015).

2. Geological overview

The Kachchh Basin is situated in Western India, wedged between the Arabian Sea and the border to Pakistan (Fig. 1). The basin formed during the early break-up of Gondwana with rifting between India and Africa from the Late Triassic onwards (Biswas, 1982, 1991). After an initial phase of terrestrial sedimentation, the sea reached the area in the Jurassic. Ammonites of the genus *Leptosphinctes* Buckman, 1920 point to marine conditions since the Bajocian (Singh et al., 1982), but the first transgression probably occurred already in the Early Jurassic (Pandey and Fürsich, 2001; Fürsich et al., 2004a; Rai and Jain, 2013). Since then, marine conditions dominated in the small, fault-bordered basin until mid-Cretaceous times (Fürsich, 1998).

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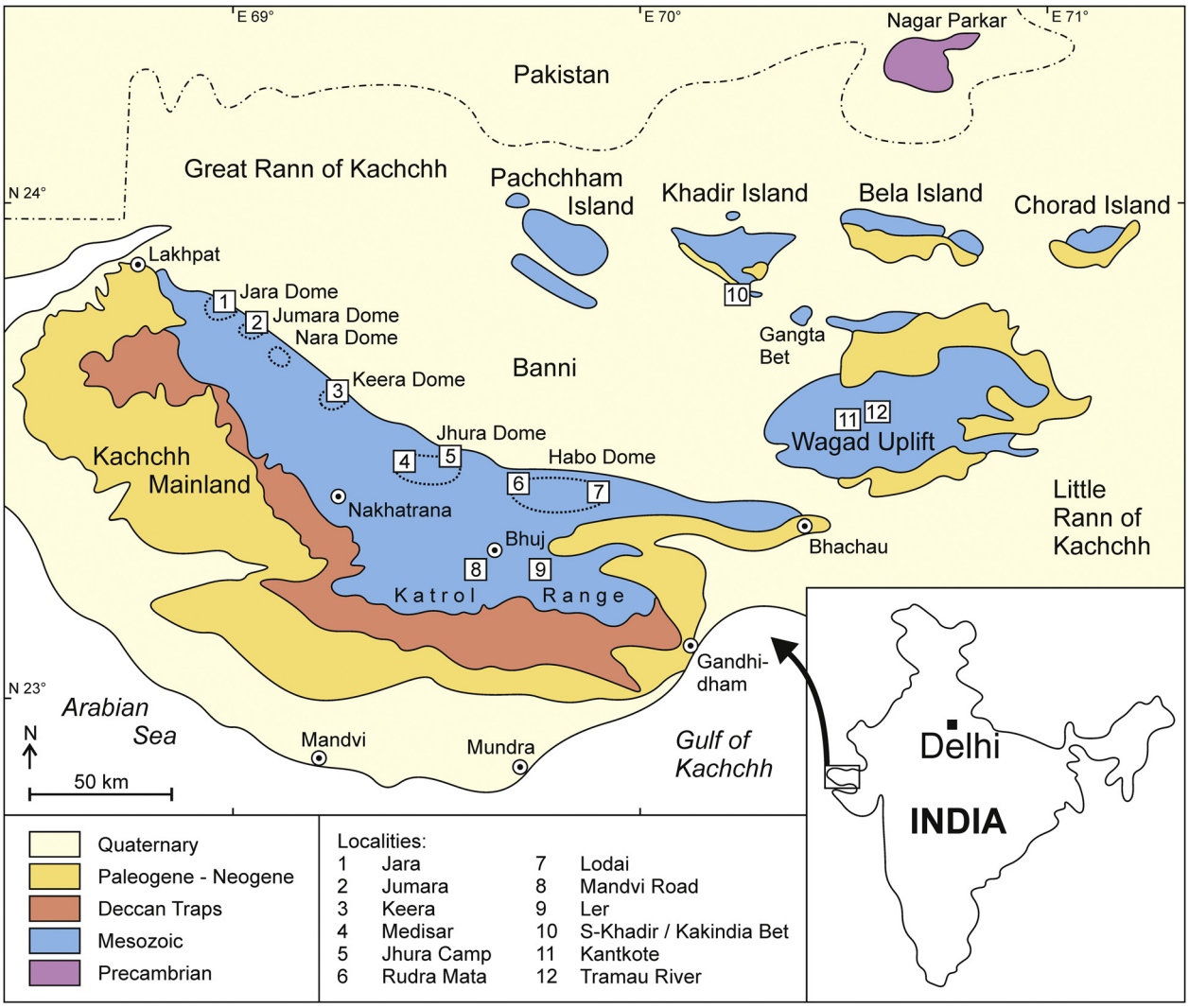

Fig. 1. Geological sketch map of the Kachchh Basin showing the sample localities. Modified after Patel et al. (2012) and Fürsich et al. (2013).

Traditionally, localities with Jurassic outcrops in the Kachchh Basin have been divided into three regions: the Kachchh Mainland, the Wagad Uplift, and the Island Belt (Fig. 1). The Kachchh Mainland occupies the central part of the basin and contains most of the well-known sections. While the southern part of the Kachchh Mainland is covered by the volcanics of the Deccan traps, the northern part adjacent to the Great Rann of Kachchh is characterized by an E-W-oriented chain of anticlinal or domal structures offering outcrops of Jurassic rocks ranging from the ?Bajocian to the Tithonian (Pandey and Fürsich, 1998; Fürsich et al., 2004a, 2004b; Krishna et al., 2009a). Furthermore, a chain of outcrops south of the district capital Bhuj displays Jurassic strata uplifted along the Katrol Hill Fault (i.e., the Charwar Hills; Biswas, 1993). The Oxfordian succession of the Kachchh Mainland is characterized by strong condensation (commonly only a few metres in thickness) and sedimentary gaps. The examined interval starts within the top of the Upper Callovian Gypsiferous Shale member of the Chari Formation (Fig. 2). This unit consists mainly of bioturbated, argillaceous silt with several levels of small ferruginous concretions and abundant secondary gypsum. The Gypsiferous Shale member is coarsening upwards into the fine-grained sandstone beds of the Dhosa Sandstone member, which is characterized by occasional cross-bedding indicating an elevated energy level due to a lower water depth. The boundary between both members seems to be diachronous. Based on peltoceratids, the basal part of the Dhosa Sandstone member is Late Callovian in age in the east (e.g., at the village Lodai) and Early Oxfordian in the west (e.g., at Jumara Dome; John H. Callomon, pers. comm. 2000; Pandey et al., 2015). The occurrence of allochthonous, ferruginous ooids marks the boundary to the Dhosa Oolite member, whose top, the Dhosa Conglomerate Bed, serves as an important marker horizon throughout the Kachchh Mainland. This strongly condensed unit has received considerable attention due to an intricate mixture of different lithologies and its complex genetic history (Singh, 1989; Fürsich et al., 1992; Alberti et al., 2013a). Although being mostly less than 1 m thick, the Dhosa Conglomerate Bed represents most parts of the Oxfordian. It contains large concretionary slabs with a Lower Oxfordian ammonite fauna floating in a fine-grained micritic matrix with reworked Lower and Middle Oxfordian ammonite taxa (e.g., Alberti et al., 2011; Pandey et al., 2012a). Additionally, at a few outcrops of the Habo Dome (e.g., 3 km east of the temple Rudra Mata) the conglomeratic matrix fills crevices cutting down into thin layers of older sandstone. After a long depositional gap encompassing parts of the Late Oxfordian and Early Kimmeridgian, sedimentation resumed in the late Early Kimmeridgian with the sandstones of