A misleading 'turtle rock' from pelagic sediments of Andaman ophiolite

'Turtle rocks' are weathered, septarian concretions that form turtles-like shapes. The calcite-filled fractures (septaria) form grooves by weathering in the concretions and give rise to fossil turtle-like appearances. Septarian concretions in limestone are normally oval in shape and resemble the backs of turtles. These are described variously as turtle rock, turtle stone or septarian concretions.

In these concretions, a series of radiating cracks crossed by numerous concentric cracks yields a turtle back-like appearance and polygonal patterns on the outer surface camouflage the concretion growth lines, misleading the concretion as a fossil turtle. Weathering has a greater effect at the corners and edges of the concretions and produces polygonal joint pattern similar to the oval turtle shape (http://www.rocksforkids.com/R&M/concretions.html#Turtlestones). Though septarian nodules are rare in limestone, they are well developed in calcite-cemented sandstone[1–3]. Earlier workers had mistaken these for fossil turtles. Turtle-like concretions from Pliocene deposits of Turkmenistan and France were described earlier as fossils (Igor Danilov, pers. commun., 2010). Many such turtle-like concretions were also reported from Kentucky, USA as fossil turtle shells, but later these have been identified as concretions (www.uky.edu/KGS/fossils/didifindegg.htm). Few publications are, however, available on turtle rocks. We report one such turtle rock from the Cretaceous pelagic limestone in the ophiolite sequence of Andaman Islands.

The Andaman and Nicobar chain of islands contain a number of N–S-trending ophiolite slices of the Cretaceous and thick Tertiary sedimentary rocks, which together make up the Mithakhari, Andaman Flysch and Archipelago Groups. The ophiolites form relatively coherent bodies, several kilometres long in the eastern part of the chain and a small, isolated klippe in the western part[4]. These ophiolite bodies are found in South Andaman, Middle Andaman and North Andaman Islands (Figure 1). The Andaman ophiolite is composed of a plutonic complex, a volcanic sequence and pelagic sedimentary rocks. The pelagic sedimentary cover is represented by a sequence of jasper, chert, rhythmically layered limestone–shale and red clay containing radiolarians, planktonic foraminifera and nanno-coccoliths of the Cretaceous–Paleocene[5].

Within pelagic limestone terrain, float-boulders resembling turtle fossils were found in the western side of Mt Baker ophiolite hill, Middle Andaman. Location of the sample is shown in Figure 1. These concretions are composed of weathered limestone.

The rock has a hard core dissected by polygonal cracks with a thin soil coating on its surface (Figure 2). The oval sample resembling a turtle has dimensions of 11 cm height, 23 cm length and width 15 cm. At a first look it gives the impression of the mould of a turtle preserving its mouth, septa in the dorsal side and septa in side lateral view. A closer look also gives an impression of typical septa of turtles (Figure 3). The septa depth varies from 2 to 0.1 cm. The maximum septa are rectangular in shape and some are pentagons. The dorsal side of the specimen is more or less flattened, with lesser cracks (septa) than the ventral side. However, it lacks the common bilateral symmetry of fossil turtles.

As limestone is prone to weathering, it is often difficult to recognize the bilateral symmetry. Turtle fossils have not been reported so far from the entire stratigraphy ranging from the Cretaceous

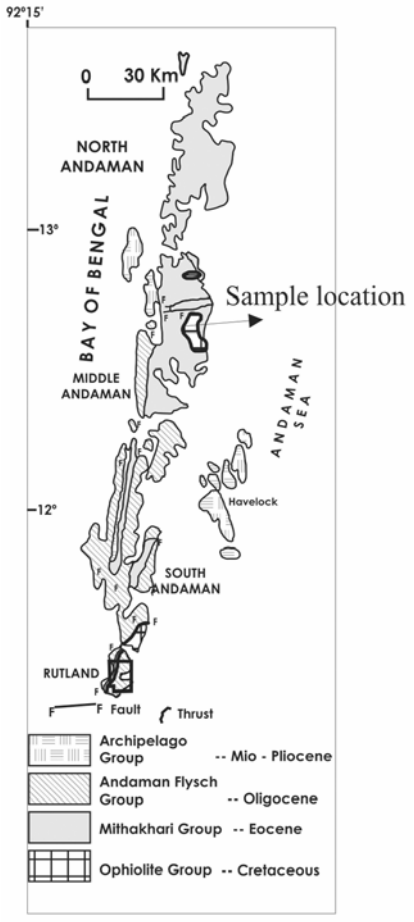

Figure 1. Geological map of the Andaman islands showing sample location (after T. Pal *et al.*[4]).

Figure 2. The turtle rock with polygonal cracks and oval shape mimicking a turtle fossil.

Figure 3. Closer view of the weathering grooves of the turtle rock resembling septa of a turtle fossil.

to Mio-Pliocene sequence of the Andaman and Nicobar Islands. Thus two options remained: (1) either it could be a mould of a turtle, or (2) a limestone concretion with the development of weathering features. Turtle fossils, although rare, have been reported from sediments of the Cretaceous[6–9]. But a closer look at the sample shows that it is not true turtle fossil but a septarian concretion of limestone commonly described as turtle rock, as it lacks typical bilateral symmetry of the vertebrate. A study of several photographs by two renowned workers on turtle (D. Brinkman and I. Danilov, pers. commun., 2010) also confirmed that it is a limestone concretion called turtle rock. Moreover, the internal cast of a turtle would have quite a different set of features reflecting the structure of the interior of a turtle shell (D. Brinkman, pers. commun., 2010).

The process of formation of septarian concretions is still not well understood. Various mechanisms are subscribed, viz. the dehydration of clay-rich, gel-rich or organic-rich cores; shrinkage of the centre of the concretion; expansion of gases produced by the decay of organic matter and brittle fracturing or shrinkage of the concretion interior[2,10]. In the Andaman example these concretions had possibly developed by shrinkage of calcareous mud that initiated cracks and subsequently filled up by calcite crystals from the circulating sea water. This happened when the ophiolite bodies were under the sea before their emplacement on land. On the other hand, these concretions could have been developed due to dehydration after the emplacement of ophiolite on land. The dehydration cracks were filled with calcite crystals precipitated from circulating solutions. Workers should be careful to distinguish between turtle rocks and turtle fossils.

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