

Morphological details of new irregular Echinoid fossil from Zirabad, India

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Abstract

Echinoids offer a unique opportunity to investigate the evolution. Our efforts of exploring extensively the fauna of Zirabad (Lat. 22°24'30" : Long. 75°04'30") has yielded some of the new irregular Echinoid fossils not cited before from this area. The present paper documents detailed morphology of one such well preserved sample of *Nucleopygus* sp from the nodular lime stone formation exposed at Zirabad near Manawar, Dhar district of Madhya Pradesh, India. The investigation enhances our knowledge on irregular Echinoids from bagh group.

Key words - *Echinoids, Irregular echinoids, Invertebrate fossils, Bagh Beds, Nucleopygus.*

Introduction

Echinoids are one of the most diverse and successful echinoderm groups today, including familiar echinoderms such as the sea urchins and sand dollars. A tough skin studded with spines covers the nonfossilized echinoderms, but in fossilized forms skeleton is composed of many calcareous plates arranged in a five-fold symmetry. Most echinoids have rigid tests, their ability to fossilize is greater than that of more delicate echinoderms. But the fossil record of echinoids is poor because soon after death they break apart into isolated plates. They are morphologically complex, which makes them relatively straightforward to classify taxonomically and phylogenetically, and they are unusual among marine invertebrates because their mode of larval development can be simply and unambiguously determined from inspection of the adult test in both extant and extinct forms (Jeffery and Emlet, 2003). In the present seas regular echinoid species outnumber irregular species; whereas, in the Tertiary only 20% of the known echinoid species are regular. This suggests that regular echinoids are less likely to be preserved than irregular echinoids. The tests of regular echinoids are exposed to scavengers and currents of water upon their death, but irregular echinoids generally live buried in the sediment and are protected from these destructive forces (Smith and Jeffery, 2000).

Fossil invertebrates have outnumbered the vertebrate fossils in India. While the southern foothills of Himalaya yield a rich store to fossils bones, its northern flanks in Kashmir, Kumaun, Spiti, Malla, Johar, Tibetan plateau, Sikkim and Assam displayed a wealth of invertebrate animal remains representing all geological ages. These fossils consisted of bivalves, ammonites, Nautilus etc. The most important outcome of the studies of Sahni (1947) is that the present site of Himalaya range was submerged at the dawn of Tertiary Era. The Tethys sea had started receding and gave birth to emerging Himalayan to its present status in a series of devastating earth movements. the salt range of Punjab surpasses all fossil localities

in richness. The Permian floating and swimming fauna of this zone suggested a much wider distribution of fauna in the Tethyan sea.

Ever since the appearance of the account of Panchu Pandoo caves near Bagh town of Barwani by Dangerfield (1818) these beds have attracted attention during last two centuries. Persons from most varied occupations like military officers, civil servants and missionaries have devoted their time to the study of these beds with different point of views like lithology, palaeontology, the status of stratigraphic component units and other aspects. But it was Keatinge (1857) who for the first time reported these beds to be fossiliferous. The fossiliferous nature of these rocks extend to a very vast area up to Jabalpur but discovery of non-marine fauna like riverine fish *Igdabatis indicus* and *Lepidosteus indicus* (Khosla *et al.* 2004) indicates the limitation of marine arm upto Dhar district only. The fossiliferous nature of these rocks extend to a very vast area up to Jabalpur but discovery of non-marine fauna like riverine fish *Igdabatis indicus* and *Lepidosteus indicus* (Khosla *et al.* 2004) indicates the limitation of marine arm upto Dhar district only. The study of Bagh group of sediments has been done by some workers but they could not give much attention to the fauna of a small village Zirabad also known as Jirabad. This area has very rich and varied marine fauna. Among the irregular echinoid, we have collected some very well preserved specimens of *Nucleopygus*, which is being reported for the first time.

Geological Setting of Zirabad Area

The sediments of bagh Group (BG) are deposited in the Narbada basin, an intracratonic trough and trends roughly east-west which is also the direction of present day Narmada river (Acharyya and Lahiri, 1991). The name is derived after a township Bagh (Lat. 22°24'30" : Long. 75°04'30") of Kukshi Tehsil, a type area for fluvial - marine sediments of BG. The out crops of BG occurs as series of detached inlineers in the Deccan Trap surrounding mostly along the northern bank of Narmada river in various localities of central India and eastern part of Gujrat state. The sedimentary rocks of BG rest on the Archean metamorphics. The lower part of the beds is arenaceous while the upper part is mainly calcareous. The generalized stratigraphic succession of BG, in order of superposition is as, Nimar sand stone formation (NSF) which is in shades of red, pink, purple; Nodular lime stone formation (NLF), which is argillaceous and light grey coloured; Chirakhan (or Deola) Marl Coralline lime stone formation CLF) which is red and yellow coloured. The overall BG sediments suggest an upper Albian-Turonian age (Chiplunkar *et al.* 1977).

It is noted that bioturbation is one of the important features of middle and top portions of NSF and rich, diversified ichnoassemblages have yielded from the top of NSF exposed at Baria and Karondia localities (Kundal *et al.*, 2000). The overlying calcareous units contain abundant and well preserved micro and mega fossils. The CLF contains abundant fragments of Bryozoa Corals etc. The Chirakhan (Deola) Marl is the chief fossiliferous horizon, but closely related fossils also occur in the lime stones above and below it. There are many species of Foraminifera, Brachiopods, Cephalopods, Lamellibranchs, Gastropods, Echinoderms etc.

The depositional environment of NSF shows two distinct phases. In the beginning the deposition commenced with distinctly fluvial sediments which uninterruptly passed into the marine estuarine sediment towards its top. The calcareous units of BG are regarded as the product of short lived eastward marine transgression of an arm of Tethyan sea i.e. arm of Arabian sea invaded from Kachchha of Gujrat to present day Zirabad areas (29 km. from amjhara on the way to Manawar on Kukshi-Manawar Road and 51 km away from Dhar.) of Manawar tehsil of district Dhar, Madhya Pradesh.

Material and Method

Among the out crops of BG of central India those in main river velly near Zirabad is unique as it represent the most complete fossiliferous succession for the paleontological investigation.

The standard methodology for palaeonological studies was adopted. This included survey and demarcation of the fossiliferous area of this village and surrounding area. Fossils were collected by digging the fossiliferous area upto the depth of two to three meters. Echinoids were also collected from the cliffs of the lime stone quarries with the help of Geological hammer, Chisel etc. Brunton Compass was used to mark the location of irregular Echinoid fossils on the Geological map. Magnifying lens was used for the field study and identification of the collected genera. Fossil specimens were numbered and details were recorded in the field note book. After returning from the field, the fossil specimens were cleaned as per standard methods for laboratory investigations and for further confirmation of the genera. For the paleontological studies we followed the systematic arrangements suggested by Smith and Jeffery (2000). Length (L) and diameter (D) of the test are in centimeters.

Observation

The sample has following dimensions - length - 35 cms. Width from oral side is 2.2 cms. height 1.1 cms. Circumference 7.5 to 8 cms. Ambulacra number 2, 3 and 4 are 1.5 cms and Ambulacra 1 and 2 are 2.2 cms long. Distance of anal sulcus from Apical Disc is 0.7 cms and length of anal sulcus is 1 cm long.

Test bilaterally symmetrical, ovate to sub quadrate in outline. Adoral surface is flat, depressed towards peristome. Subanal heel in side view is very clear.

Aboral View

Peristome is small. Buccal notches are absent. In front and rear of Peristomial area is broad naked and pitted. Plating of all the five inter ambulacral zones on the oral surface are similar. There is no plastron.

Oral View

Ambulacra with differentiated tube feet are present. Pore pairs forming Phyllodes and petals. Phyllodes (adoral zones of food harvesting tube feet) developed adorally. Single irregular series of pore pairs (Tube feet) to each ambulacral plate beneath petals. Pore zones expanded close to peristome. Plating simple or with small adradial pyrenoid elements.

Apical Disc

Apical disc is on anterior side and is monobasal. Apical plate with genital plate 3 is perforated by a gonopore. Four gonopores are present.

Periproct

Periproct is aboral and supra marginal. It is transversely elongated and associated with a shallow subanal ledge or short and groove called as anal sulcus. Anal sulcus is not in contact with apical disc.

Distribution - Albian to Turonian

Classification: Echinoidea, Irregularia, Cassiduloida, Apatopygidae, *Nucleopygus Sp.*

Discussion

Nucleopygus is similar to *Apatopygus* in having a tetrabasal apical system, with four gonopores, a supramarginal periproct with an anal sulcus and simple phyllodes with only a well defined outer series of single pores Desor, (1842). It differs from *Apatopygus* and *Porterpygus* in lacking pyrroid plating ambulacra beyond petals. Kier, (1962). *Nucleopygus* is superficially similar to the nucleolitids, however, these genera are double pored beneath the petals and lack buccal pores (Smith, and Jeffery, 2000).

It is worth while to point out that Cement industries and Man irrigation project have already damaged the lime stones and fossils bearing localities. Therefore authors suggest that looking to the presence and diversity of the marine fossils in Zirabad area sediments of BG must be properly preserved for future generation and study.

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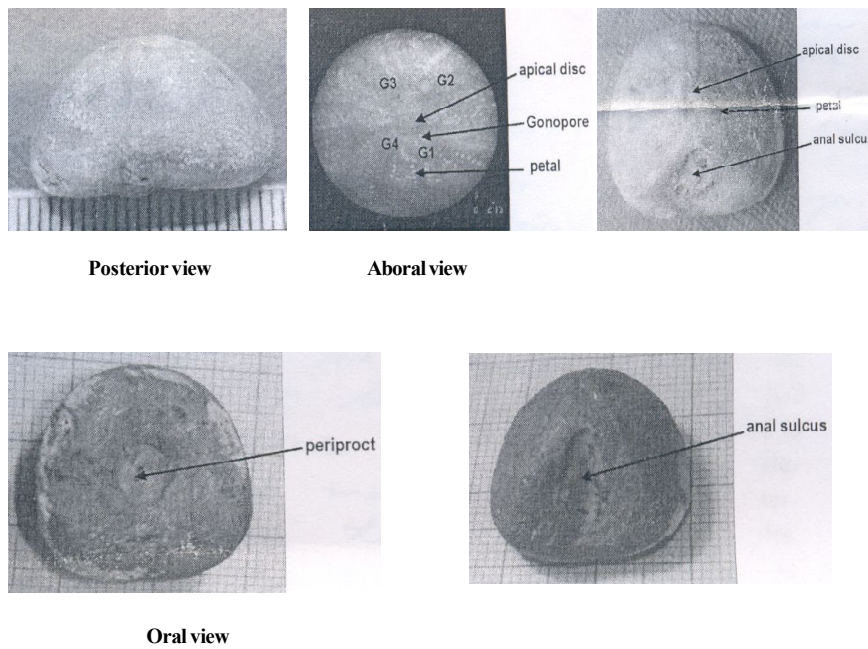


Fig 1: Morphological details of *Nucleopygus* sp.
Social cost benefit analysis of Sultanpur National park, Haryana