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A note on fossil sea urchin *Rhabdocidaris* sp. (Echinoidea: Cidaroidea) from Kirther range offering a new record from Pakistan

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ABSTRACT

Echinoids echinoderms are a major group of marine invertebrates with a long fossil record. The oldest echinoids originated during the late Ordovician period, estimated to be about 450 million years ago. Three specimens of *Rhabdocidaris* sp. (fossil echinoid) belonging to the family Cidaridae are reported for the first time from Kirther range, located in Sindh province. A brief note on the specimens at hand is given.

Keywords: Echinoidea, *Rhabdocidaris* sp., fossil, new record, Pakistan.

1. INTRODUCTION

In the early Cenozoic, the echinoids have provided a great deal of information about biotic and climatic evolution. Marine animals of the clade Echinoidea are among the most iconic in the animal kingdom. All latitudes and depths are home to echinoids in benthic marine environments. Marine communities like coral reefs, kelp forests, and sea grass meadows are influenced heavily by their abundance and trophic interactions, which can cause ecosystem-wide shifts to low diversity stable conditions (Carpenter, 1981; Harrold and Pearse, 1987; Valentine and Heck, 1991; Hughes, 1994; Edmunds and Carpenter, 2001; Ling et al., 2015). In the same way, bioturbation associated with feeding and burrowing activities of a large diversity of echinoids influences marine sedimentary environments on a large scale (Radwanska, 1999; Lohrer et al., 2004). In addition to their robust globular skeleton, which is composed of calcium carbonate plates, echinoids exhibit other morphological characteristics.

Complex structures provide an abundance of morphological information that can be synthesized into morphological matrices encompassing both extant and extinct species (Suter, 1994; Smith, 2001; Radwanska, 2003; Stockley et al., 2005; Kroh and Smith, 2010). Echinoids have several unique properties, including a remarkable fossil record that can be used to investigate macroevolutionary dynamics (Desor, 1855-

1858). The resilience of echinoid tests contributes to their remarkable fossil record, which includes more than 10,000 described species; this is underscored by their high preservation potential (Kidwell and Baumiller, 1990; Nebelsick, 1996; Smith and Kroh, 2013). Earlier published literatures are available on the echinoid fauna of India and Pakistan by (Grant, 1837). The species which have been described and illustrated from Pakistan as fossil are given in the following list, together with their respective localities, geological ages, and original names.

2. MATERIALS AND METHODS

The material studied of fossil Echinoids known from Pakistan (Kirther range, Sindh province) (Lat. 27° 21' 49" N, Long. 67° 10' 10" E) (Figure 1). Located along the western border of the Indus Valley, the Kirthars form part of the Kirthar-Sulaiman geologic province that stretches from the Arabian Sea coast north to northwestern Pakistan. In the upper and middle portions of the mountains, there is mostly limestone, while in the southern and middle portions, there is shale associated with the middle Eocene period (Teiichi et al., 1964). The collections studied stored in the Marine Reference Collection and Resource centre, University of Karachi.

Age

Eocene (40 – 60 MYA), Laki Formation

Size

Between 7 -12 mm in diameter and 4 - 8 mm high.

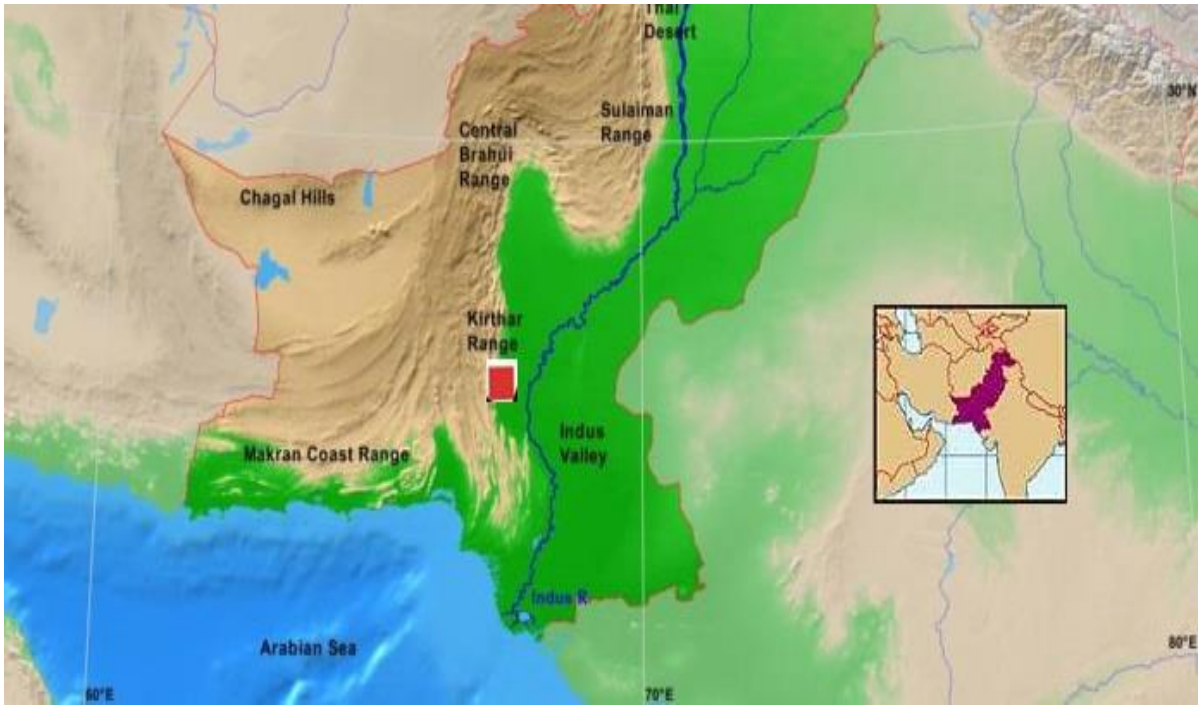

Figure 1 Map of Kirther range, solid mark indicate collection site.
(Source: https://alearningfamily.com/main/pakistan-physical-map/)

Systematic

Class: Echinoidea
Subclass: Cidaroidea
Order: Cidaroida
Superfamily: Cidaroidea Gray, 1825
Family: Cidaridae Gray, 1825

Subfamily: Cidarinae Gray, 1825
Genus *Rhabdocidaris* Desor, 1855
Rhabdocidaris sp. (Figure 2)

3. RESULTS AND DESCRIPTION

Diagnosis

High interambulacral plates with a single massive primary spine and a smaller secondary spine that is usually spatulate; mature primary spines often encrusted with epizoic organisms; simple ambulacral plates with pore-pairs in a single vertical series, sometimes sinuous; tubercles are perforated, crenulated, and mamelons grow adacately. Tubercles are heterogeneous in the oro-ambulacral region, with every second tubercle enlarged; there are no differences between the ambital and apical tubercles. Incisions and separations of the areoles are hardly noticeable. During testing, the peristome is covered with both ambulacral and interambulacral overlapping plates, but the main part remains rigid throughout. A small number of scrobicular tubercles; the circles are converging under the ambitus. Tuberculation is moderately dense and heterogeneous in extrascrobicular zones. Furrows or pits on the sutural surface are not present. Its primary spines are typically stout, flattened, and spatulate distally. It usually has one side that is relatively smooth, with a few small thorns, and the other with a few strong ribs that are coarse, serrated, or thorned. Short collar and neck.

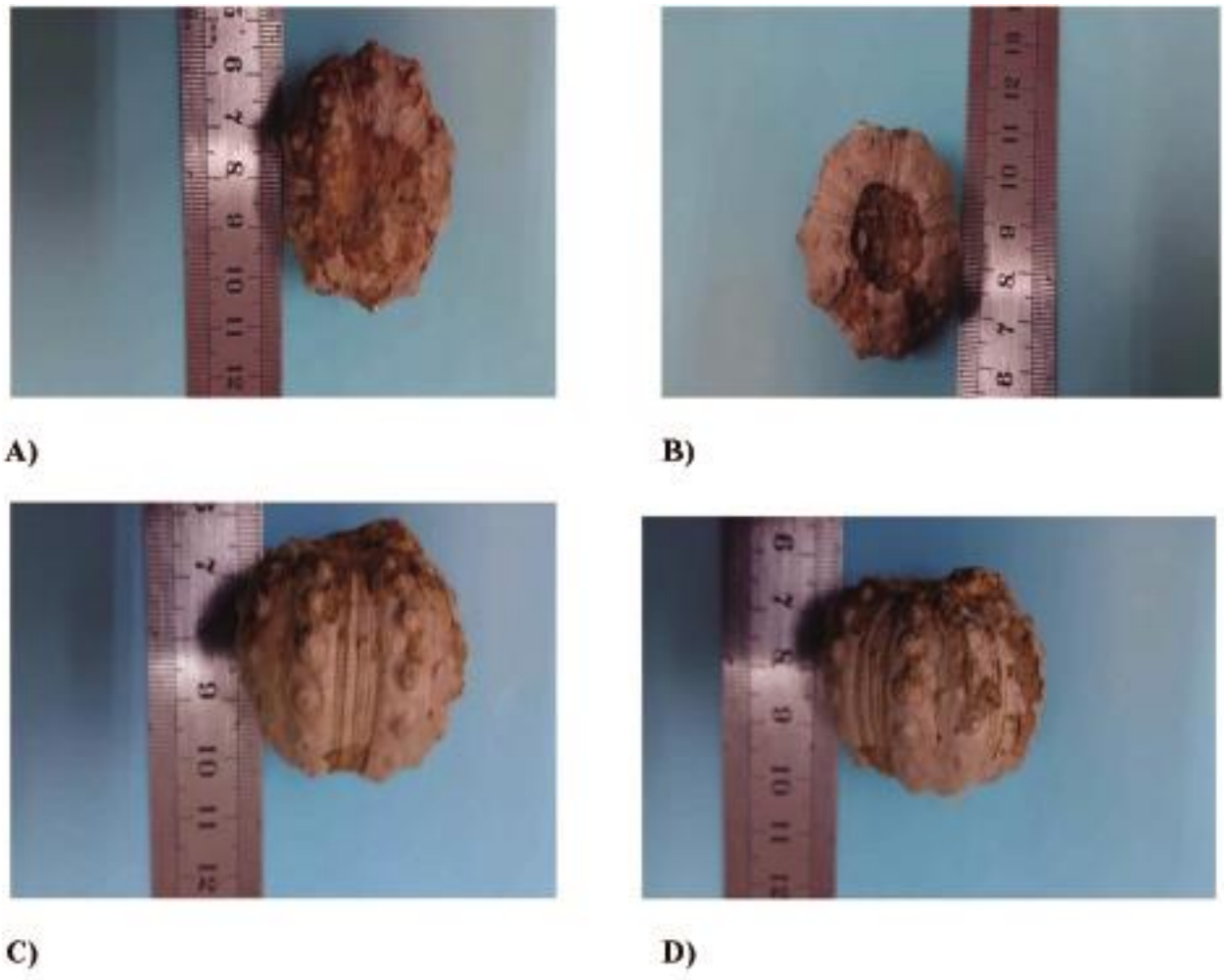

Figure 2 *Rhabdocidaris* Sp. A, Aboral view of the test; B, Oral view of the test; C, Lateral view of the test, to show ambulacrum; D, Lateral view of the test, to show interambulacrum.

Remarks

The present study recorded *Rhabdocidaris* sp. for the first time from the Pakistan. There is still uncertainty regarding the taxonomic status of the majority of echinoid fauna described from the Indian subcontinent previously. In addition, this information is useful for studying palaeobiogeography and evolutionary trends among certain groups of echinoids. It is essential to update taxonomically the fossil echinoids in light of taxonomic revisions and recommendations as presented in the new literature, so that they can be useful stratigraphically.

Conflicts of interests:

The authors declare that there are no conflicts of interests.

Funding:

The study has not received any external funding.

Ethical approval

The ethical guidelines for fossil materials are followed in the study for species collection & identification.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES

1. Carpenter R. Grazing by *Diadema antillarum* (Philippi) and its effects on the benthic algal community. J Mar Res 1981; 39:749 -765.
2. Desor E. *Synopsis des echinides fossiles*. C Reinwald, Paris, 1855-1858; 490.
3. Edmunds PJ, Carpenter RC. Recovery of *Diadema antillarum* reduces macroalgal cover and increases abundance of juvenile corals on a Caribbean reef. Proc Natl Acad Sci USA 2001; 98 (9):5067–5071. doi: 10.1073/pnas.071524598
4. Grant CW. Memoir to illustrate a geological map of Kutch, geological papers on western India including Cutch, Sinde with an atlas of maps and plates. Trans Geol Soc Lond 1837; 5 (2):289–326.
5. Harrold C, Pearse JS. The ecological role of echinoderms in kelp forests. In M Jangoux and JM Lawrence, eds. Echinoderm studies. AA Balkema, Rotterdam, 1987; 2:137-233.
6. Hughes TP. Catastrophes, phase shifts, and large-scale degradation of a Caribbean coral reef. Sci 1994; 265(5178):1547 –1551.
7. Kidwell SM, Baumiller T. Experimental disintegration of regular echinoids: roles of temperature, oxygen, and decay thresholds. Paleobiology 1990; 16(3):247–271.
8. Kroh A, Smith AB. The phylogeny and classification of post Palaeozoic echinoids. J Syst Palaeontol 2010; 8(2):147–212. doi: 10.1080/14772011003603556
9. Ling SD, Scheibling RE, Rassweiler A, Johnson CR, Shears N, Connell SD, Salomon AK, Norderhaug KM, Pérez-Matus A, Hernández JC, Clemente S, Blamey LK, Hereu B, Ballesteros E, Sala E, Garrabou J, Cebrian E, Zabala M, Fujita D, Johnson LE. Global regime shift dynamics of catastrophic sea urchin overgrazing. Philos Trans R Soc Lond B Biol Sci 2015; 370 (1659):20130269. doi: 10.1098/rstb.2013.0269
10. Lohrer AM, Thrush SF, Gibbs MM. Bioturbators enhance ecosystem function through complex biogeochemical interactions. Nat 2004; 431(7012):1092-5. doi: 10.1038/nature03042
11. Nebelsick JH. Biodiversity of shallow-water Red Sea echinoids: implications for the fossil record. J Mar Biol Assoc UK 1996; 76(1):185–194.
12. Radwanska U. Lower Kimmeridgian echinoids of Poland. Acta Geol Pol 1999; 49:287-364.
13. Radwanska U. A monograph of the Polish Oxfordian echinoids. Part 1, Subclass Cidaroidea Claus, 1880. Acta Geol Pol 2003; 53(2):143-165.
14. Smith AB. Probing the cassiduloid origins of clypeasteroid echinoids using stratigraphically restricted parsimony analysis. Paleobiology 2001; 27(2):392–404.
15. Smith AB, Kroh A. Phylogeny of sea urchins. In: Lawrence J.M., editor. Sea urchins: biology and ecology, 3rd ed. Cambridge: Academic Press, 2013; 1–14.
16. Stockley B, Smith AB, Littlewood DTJ, Lessios HA, Mackenzie-Dodds JA. Phylogenetic relationships of spatangoid sea urchins (Echinoidea): taxon sampling density

and congruence between morphological and molecular estimates. Zool Scr 2005; 34:447–468
17. Suter SJ. Cladistic analysis of cassiduloid echinoids: trying to see the phylogeny for the trees. Biol J Linn Soc 1994; 53(1):31–72.
18. Teiichi K, Ryūzō T, Wataru H. Geology and Palaeontology of Southeast Asia. University of Tokyo Press, 1964.
19. Valentine JF, Heck Jr KL. The role of sea urchin grazing in regulating subtropical sea grass meadows: evidence from field manipulations in the northern Gulf of Mexico. J Exp Mar Bio Ecol 1991; 154(2):215–230.