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Some Data on a Sample of the Sanddollar Encope emarginata (Leske, 1778) from the Coast of Santa Catarina, Brazil*

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Encope emarginata is one of the most widespread species of sanddollars in the Americas. It occurs in depths from some 50 metre upwards in sandy and shallow coasts from Florida to Uruguay along the Atlantic (Mortensen 1948, Tommasi 1966). In full grown specimens the lunulae tend to close, but the process obviously is not known very well (Tommasi 1964, 1966). The species varies to some degree in size and perhaps in other fea-

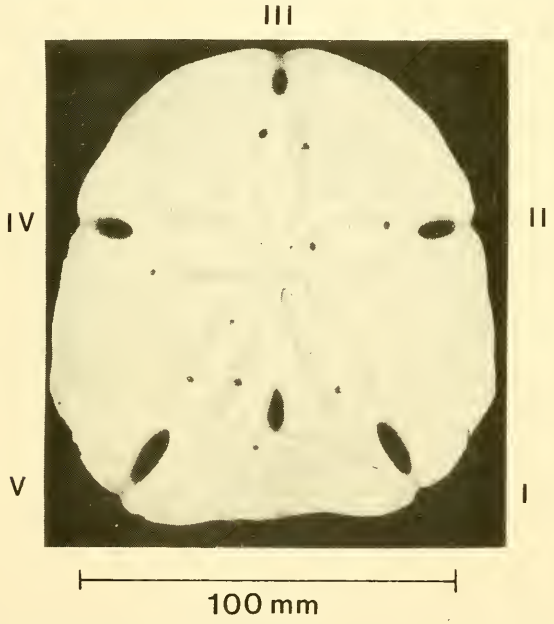

Fig. 1: Aboral view of the calcareous skeleton of *Encope emarginata* from Pôrto Belo, S. C., Brazil (Nov. 8, 1970). I to V = radials.

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tures, but data are scanty. This paper should provide some measurements from a sample collected on November 8, 1970, in the bay of Pôrto Belo, Estado de Santa Catarina, Brazil.

A total of 33 specimens were found washed ashore just at the mouth of the small creek called Rio Rabelo near the village of Pôrto Belo after a heavy storm the night before. The river delta is formed by soft mud and meets the currents which may develope between the mainland and an island, the Ilha João da Cunha. Water's depth falls steadily to about 5 metres with no deeper place within the whole bay.

The sanddollars could be found only at this place, despite the fact that the storm had washed numerous sea urchins ashore everywhere for some kilometres. Thus the sample might belong to a local population and could be treated as a representative of the major size classes of this species within that area.

All specimens were measured for height and width, and exact drawings were taken to show the state and position of the lunulae. A typical specimen is shown in fig. 1. Air dry weight has been taken additionally. It is roughly equal to the amount of calcareous material in the shell. The average is 56 g with a standard deviation of ± 9 g and a range of values from 32 to 77 g.

Length, measured from the front across the large interradial lunule, varied from 102 to 128 mm, the range of width being 95 to 118 mm. The average size for all the 33 specimens is 116×108 mm. This value shows the small but clearly visible preponderance of length against width. Fig. 2 depicts the correlation between increasing length and width (r =

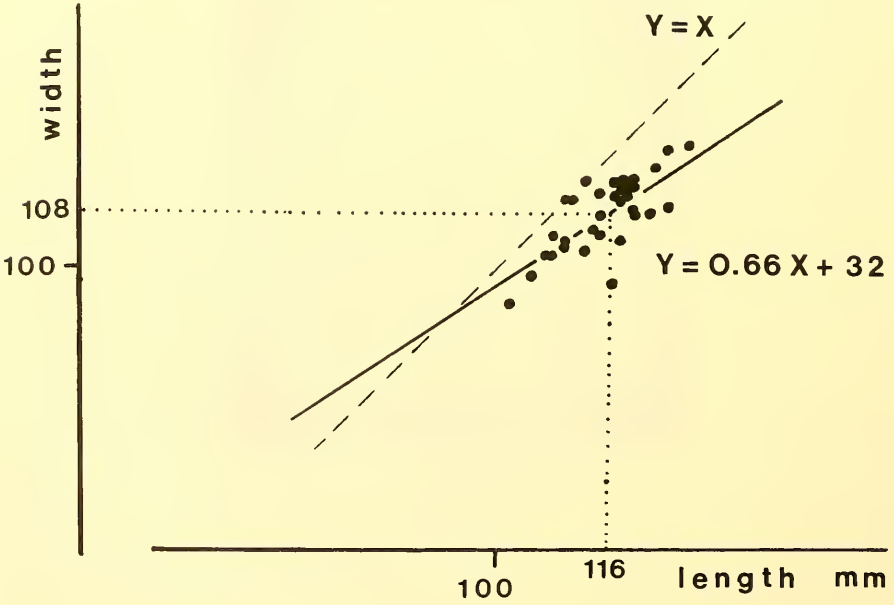

Fig. 2: Regression length/width of *Encope emarginata* (n = 33 specimens) from Pôrto Belo, S. C., Brazil (Nov. 8, 1970). The regression line clearly departs from the line for equal radial growth (Y = X). Values for the average are indicated.

Tab. 1: Size classes and distal closure of the lunulae in Encope emarginata from Southern Brazil.

size class (mm)	100–105	106–110	111–115	116–120	121–125	126–130
average number of closed lunulae	0	2	3	2	3	4
number of specimens per size class	2	6	7	13	4	1

Tab. 2: Symmetries of the lunulae (I–V, radials) compared to the 'guiding' one (III). The large rear lunuale has been excluded for this purpose!

III similar to	II/IV	I/V	I–V	none	unsymmetrical
number of cases	7	8	12	2	4

0.735). But since there are some specimens with quite round a shape, the correlation coefficient (r) is not very high.

Following this growth pattern, there should be a tendency for closing the five radial lunulae with increasing size (Tommasi 1964). In fact the two specimens in the smallest size class from 100 to 105 mm length show all the radial lunulae open. Among the largers some specimens occur with all the lunulae closed up totally at the distal end. But statistical treatment of the total sample does not prove this assumption. There is no significant correlation between size and the number of lunulae closed (cf. table 1). The correlation coefficient only amounts to 0,24 with a slope of the regression line of 0.066. Thus the sample was either too small or the collected specimens were still below the full grown size. The latter can be outruled, becasse the average of the size lies well within the expected values for full grown specimens according to Mortensen (1948). Tommasi (1966) probably overestimated the tendency for closing the lunulae, but it might be possible that different local populations react differently according to environmental factors or genetic predispositions. Closed lunulae however should not be taken as an evidence for full grown specimens of *Encope emarginata* sanddollars.

But the first look at the material suggests such a relationship indeed. This may be caused by another tendency, which results from the general superimposition of bilateral symmetry to the radial growth pattern. The lunulae tend to close symmetrically, which is shown by table 2. From the five rays those behind the 'guiding' one (number III, the "head-part" of the disc) much more often remain open or are closed in the same way on each side, thus producing the impression of a tendency towards external bilateral symmetry with increasing size.

A superficial look at the outer shape, however, makes it difficult to distinguish between radial and bilateral expressions of symmetry if all the lunulae are open or closed.

Trying to separate pure radial pattern from externally 'pure' bilateral or the 'unsymmetrical' types one can allot the specimens according to the state of closure and symmetry to the different classes of 4 basically "symmetrical" types of pattern. Four specimens have to be excluded because of irregular sequences of the closing of the lunulae. So 17 of the 29 specimens clearly express the bilateral pattern, which is present, of course, in the remaining 12 specimens too, but they show a 'pure' radial growth pattern.

This result clearly demonstrates the pronounced tendency towards the expression of the superimposed bilateral symmetry in this species of irregular echinoderms. The departure of the regression line in fig. 2 from an exactly radial (Y = X) might be used as a measure for this tendency and enable comparisons between different kinds of species and subspecific populations.

Zusammenfassung

Einige Daten über den Sanddollar *Encope emarginata* (Leske, 1788) von der Küste von Santa Caterina, Brasilien

Die Untersuchung von 33 Sanddollar-Seeigeln *(Encope emarginata)* von Pôrto Belo, S. C., Brasilien, ergab bei einem durchschnittlichen Gewicht von 56 g des Skeletts eine mittlere Größe der offenbar ausgewachsenen Individuen von 116×108 mm. Im Gegensatz zu Literaturangaben ließ sich keine Zunahme der Schließung der Lunulae am distalen Ende mit zunehmender Körpergröße nachweisen, was möglicherweise auf Unterschieden in Lokalpopulationen beruht.

Die Tendenz zur äußeren Ausprägung der sekundären Bilateralsymmetrie ist deutlich erkennbar und zeigt sich u. a. auch in der Neigung zu symmetrischem Verhalten der einander gegenüberliegenden Lunulae. Die in Abb. 2 dargestellte Abweichung von radial gleichmäßigem Wachstum könnte als Maß zum zwischen- und innerartlichen Vergleich benutzt werden.

Literatur

MORTENSEN, T. 1948: A Monograph of the Echinoidea. IV. 2. – Reitzel, Kopenhagen.

TOMMASI, L. R. 1966: Lista dos Equinóides recentes do Brasil. – Contr. Inst. Oceanogr. Univ. S. Paulo, sér. Ocean. biol. **11**: 1–50

— — 1964: Observações sôbre equinóides do Brasil. Rev. Brasil. Biol. **24**: 83–93

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