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Ordovician chitinozoans from Portixeddu, Sardinia

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ABSTRACT — The Ordovician slates (scisti argillosi) *at Portixeddu, southwestern Sardinia Italy, contain one taxon of chitinozoans,* Conochitina elegans *Eisenack 1931, which is described and illustrated. It suggests a Caradocian age for the upper part of the slate sequence.*

RIASSUNTO - [CHITINIZOI ORDOVICIANI DI PORTIXEDDU, SARDEGNA] — *Viene descritta e illustrata* Conochitina elegans *Eisenack 1931 proveniente dagli Scisti argillosi di Portixeddu (Sardegna sud occidentale). Essa suggerisce una età caradociana per la parte superiore della serie*

INTRODUCTION

With the exception of conodonts (Serpagli 1967; 1970) almost nothing is known about the micropalaeontology of the Lower Palaeozoic rocks of Sardinia. Accordingly, when I had an opportunity to study the geology of the southern part of the island during a short field trip in 1970, I decided to collect Ordovician and Silurian rock samples for micropaleontological investigation from the areas visited. The samples were processed for organic-walled microfossils. One of the Ordovician and two of the Silurian samples proved to contain chitinozoans. The Ordovician chitinozoans from Portixeddu on the Iglesiente coast of southwestern Sardinia are dealt with in this paper. The single species encountered has no major stratigraphic importance, but it provides evidence that the strata studied in Portixeddu are of Caradocian age. Since almost nothing is known about Ordovician Chitinozoa in the entire West Mediterranean area, all new data deserve to be reported. Furthermore, all faunal components of the Ordovician slates and siltstones of the Iglesiente area are now under review (Maccagno 1965, p. 149; Serpagli 1969), and the present study may be regarded as a complement to these investigations.

ACKNOWLEDGEMENTS

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Helge Ax:son Johnsons Stiftelse and *Höganäs AB* have kindly made the use of a Jeol Scanning Electron Microscope possible for me.

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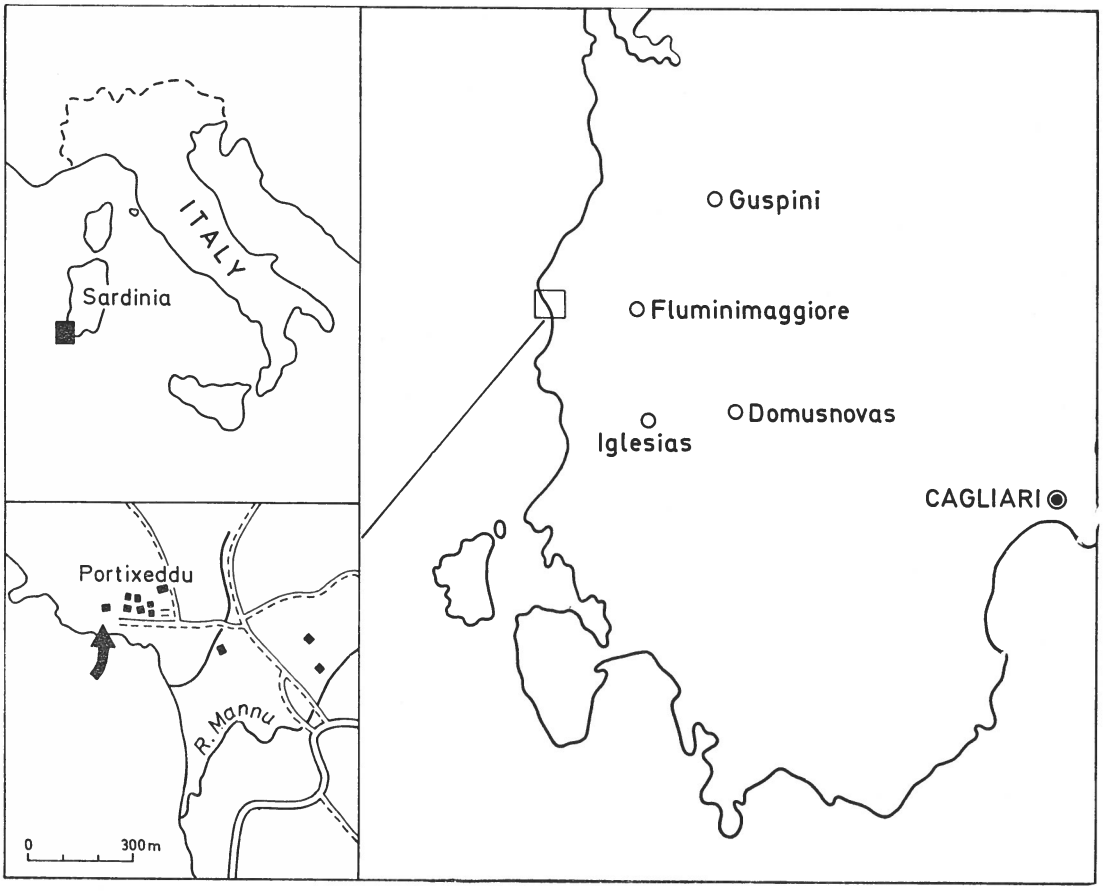
GEOLOGICAL SETTING

The southwestern part of Sardinia — the Iglesiente area — is geologically separated from the main part of the island by a graben — the Campidano basin — the southwestern margin of which roughly follows a line from Cagliari through Guspini (text-fig. 1). The bed-rock of Iglesiente consists of sedimentary, metamorphic and plutonic Palaeozoic rocks. The Cambrian sedimentary succession — the Iglesiente Group — has a total thickness of 1000-1500 metres (Poll 1966). After the deposition of these Early and Middle Cambrian strata, the area was subjected to orogenic movements which are commonly referred to as the Sardic phase of the Caledonian orogeny. Later, possibly in the Arenigian,the sea transgressed over the folded and deeply weathered area. (It should be noted that the precise stratigraphic control of this orogenic phase in its « type area » is so poor that the Sardic phase as a regional concept is of very little use).

The Ordovician is represented by a basal sedimentary breccia or by conglomerate beds overlain by more or less sandy slates or siltstones of a combined thickness of 250-400 metres (Poll 1966, p. 132). The slates have been subdivided into two biostratigraphic units.



Text-fig. 1 - Index map of southwestern Sardinia showing the location of Portixeddu. The inset map in lower left corner is showing the village of Portixeddu. The black arrow is pointing at the sample locality in the abandoned quarry in the outskirts of the village. Modified from Serpagli 1969.

The lower of these is characterized by the occurrence of « *Asaphus nobilis, Dalmania, Trinucleus, Lingula,* and *Scyphocrinus* », whereas the upper unit has been distinguished by the presence of *Nicolella actoniae* and a wealth of bryozoans and cystoids (see Serpagli 1969, p. 4). The two slate units have been referred to as Middle and Upper Ordovocian, respectively, by most authors (e.g., Taricco 1921; Gortani 1922; Serpagli 1969).

Only the richly fossiliferous upper unit has been subject to recent investigations. In her study of the cystoids, Maccagno (1965) considered this unit to be of Ashgillian age. In a paper on the conularids, Serpagli (1969) confirmed earlier views of a Caradocian age of this unit. The chitinozoans reported on in this paper are from the same stratigraphic interval as that investigated by Maccagno and Serpagli.

As for the remaining part of the Palaeozoic sequence of the Iglesiente area it suffices in this connection to mention that the Silurian is very thin (probably less than 100 m) and consists of black, graphitic slates with thin intervals or lenses of dark, fossiliferous limestone (Poll 1966; Serpagli 1967, 1970). The transition between the Ordovician and the Silurian is not exposed in the Portixeddu area. It seems probable, however, that this transition is gradual, as described by Poll (1966, p. 132) in the area southeast of Iglesias (see text-fig. 1).

SAMPLE LOCALITY

Along the Iglesiente coast, close to the small village of Portixeddu (see inset map, text-fig. 1) there are beautiful exposures of the richly fossiliferous upper part of the Ordovician slate succession. The sample locality is situated in II NE of the topographical map sheet *Capo Pecora* (Fo 224) of *Carta d'Italia dell'I.G.M.*

The rocks exposed at this locality consist of arenaceous siltstones with slaty cleavage, and are dissected by several faults. The sequence has never been mapped in detail. For a faunal inventory of the rocks and for photos of the section, the reader is referred to the papers by Maccagno (1965) and Serpagli (1969).

The sample yielding chitinozoans was collected in the small abandoned quarry along the path immediately west of the village. The quarry has been photographed by Maccagno and the exact sampling spot is the small protruding cliff exposed far to the right in her photograph(see Maccagno 1965, Pl. 1, fig. 4).

SAMPLE PROCESSING

About 1 kg of rock material, representing a 0.5 m thick vertical sequence, was crushed to hazel-nut size. The crushed material was mixed and divided in eight parts, one of which (125 g) was used for acid treatment. This sample was dissolved in concentrated hydrofluoric acid with a little hydrochloric acid (conc.) added to avoid forming of complex fluorides. After the complete dissolution of the digestible portion of the sample, the residue was sifted under gently running water in a nylon sieve (mesh size 45μ).

The sifted residue contained a large amount of small cubic crystals of pyrite. The residue was therefore dissolved in concentrated nitric acid and sifted again. It deserves mentioning that the presence of pyrite crystals is a good indicator of the unweathered state of a sample, hence no selective destruction of the organic-walled microfossils has taken place.

The residue left in the sieve was collected in a low plastic beaker and studied under microscope.

CHITINOZOA

Chitinozoans were the only organic-walled microfossils encountered in the sample from Portixeddu. It contained only 40 specimens, i.e., 0.25 specimen per gram of rock which is a very low frequency. All specimens are preserved in full relief which is remarkable considering the deformation of the rocks. The

effect of the tectogenesis, however, is expressed in the strong carbonization of all specimens. The vesicle surface of the chitinozoans has a metallic luster.

All specimens recorded can be referred to one and the same species.

CONOCHITINA ELEGANS Eisenack, 1931
(Pl. 1, figs. 1-4)

Conochitina elegans EISENACK, 1931, Pal. Zeitschr., vol. 13, p. 87, Pl. 2, fig. 4,
Rhadochitina conocephala EISENACK, 1934, Pal. Zeitschr., vol. 16, pp. 61-62, text-fig. 32, Pl. 4, figs. 10-12,
Conochitina elegans EISENACK, 1959, N. Jb. Geol. Pal. Abh., vol. 108, pp. 3-4, text-fig. 1, Pl. 2, figs. 4-5,
Conochitina elegans EISENACK, 1962, Senck. leth., vol. 43, p. 357,
Conochitina elegans EISENACK, 1965, N. Jb. Geol. Pal. Abh., vol. 123, pp. 126, 133, Pl. 10, fig. 9,
Conochitina elegans JENKINS, 1967, Palaeontology, vol. 10, p. 455, Pl. 71, figs. 1-4,
Conochitina elegans EISENACK, 1968, Palaeontographica, vol. 131, part A, p. 161.

Material — 40 specimens preserved in full relief.

Description — The vesicle is conically elongated with greatest width at the basal edge. There is a constriction of the body just oralward of the basal edge. In some specimens, the middle part of the body is slightly convex. The flexure is broadly rounded or absent. No undamaged aperture has been encountered. The base is slightly convex and no concentric growth lines or mucro have been noticed. The interior part of the vesicle is without ornamentation. Prosome or other internal structures are not preserved in the present material. The vesicle wall is perfectly smooth (Pl. 1, fig. 3). All specimens are straight.

Dimensions — Width of basal edge: 55-86 μ, $\bar{x}$ 69.4 μ. Length: All specimens have a more or less fragmentary oral part and no representative figures can be given. The length of the specimens in the population is estimated as being moderate. Probably no specimen was longer than about 500 μ.

Remarks — A few specimens have small corrosion pits in the vesicle wall (Pl. 1, fig. 1). It is not possible to say if these pits have been formed by microbial activity early in the diagenesis of the enclosing sediment or if they were formed epidiagenetically during the tectogenesis.

Horizon and locality — Upper part of the Caradocian « scisti argillosi ». Small abandoned quarry in Portixeddu, southwestern Sardinia, Italy.

Occurrence — Eisenack (1931, 1959, 1962, 1965, 1968) described *Conochitina elegans* from erratic boulders and from the Caradocian Kukruse, Jõhvi and Keila stages of Estonia. According to current correlations the species is restricted to strata corresponding to the graptolite zones of *Nemagraptus gracilis* (upper part), *Diplograptus multidens* and *Dicranograptus clingani* (lower part) in that area.

EXPLANATION OF PLATE 1

Scanning electron micrographs of *Conochitina elegans* Eis. 1931 from the Caradocian of Portixeddu, Sardinia

Fig. 1 - Detail of vesicle surface. Corrosion pits in the body wall close to the basal edge. Same specimen as Fig. 2. Ca. x 3000.

Fig. 2 - Oblique aboral view of vesicle. Same specimen as Fig. 1. Ca. x 450.

Fig. 3 - Detail of smooth vesicle surface. Same specimen as Fig. 4. Ca. x 1700.

Fig. 4 - Lateral view of vesicle. Same specimen as Fig. 3. Ca. x 450.

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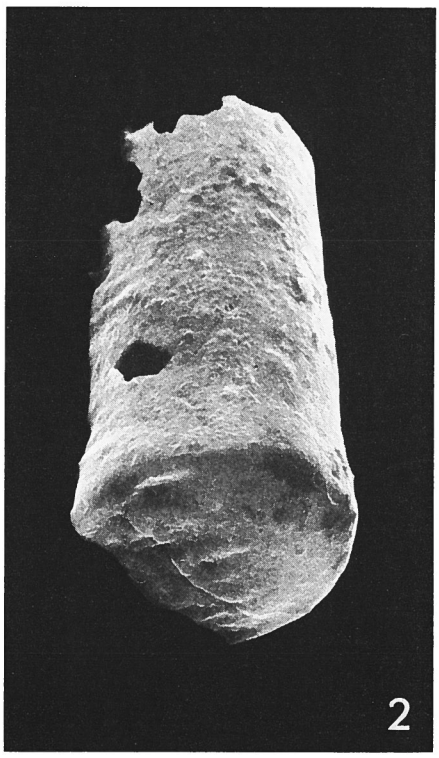
1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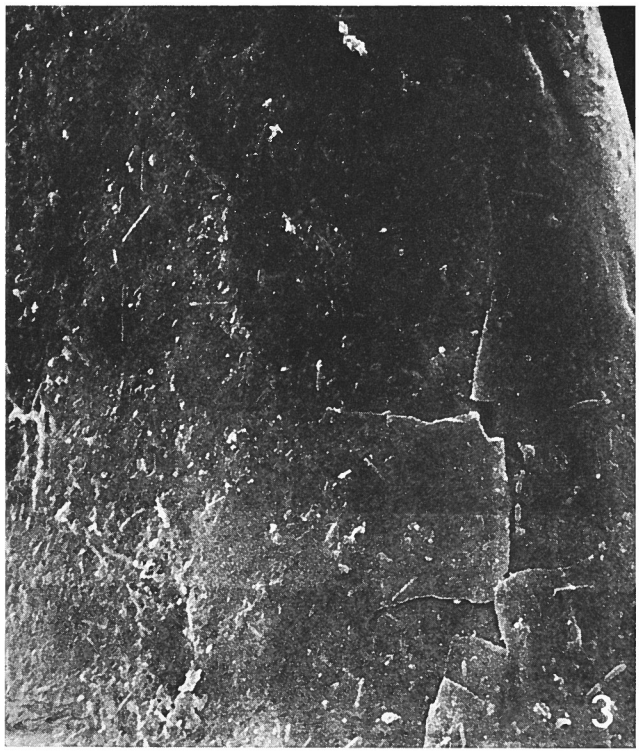
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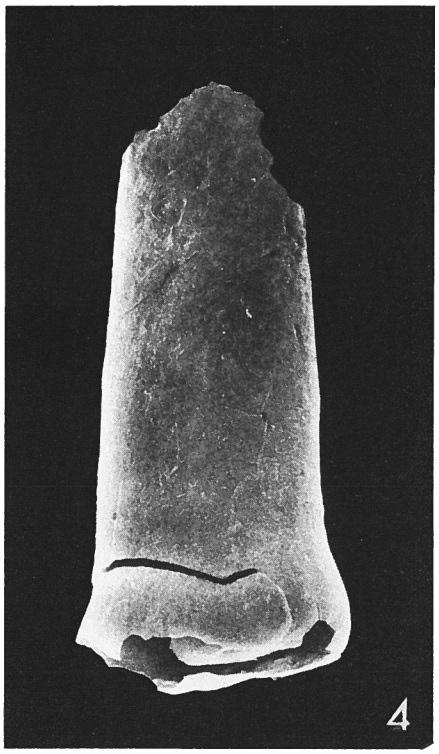
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In Wales *C. elegans* has been reported from the Costonian through Onnian stages of the Caradocian (Jenkins 1967), that is from the upper part of the *gracilis* Zone through the *multidens* and *clingani* Zones if Bergström's (1971) biozonation is used. If the zonal scheme of Ingham and Wright (1970) and Williams et al. (1972) is adopted, *C. elegans* ranges up into the *Pleurograptus linearis* Zone. It should be mentioned, however, that very little is known about the Ashgillian chitinozoans in Great Britain. Nevertheless, it seems probable that *Conochitina elegans* is restricted to the Caradocian.

Repository — The specimens figured are kept in the type collections of the Department of Historical Geology and Palaeontology, University of Lund, Sweden, under the designation LO 4577 t.

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Microstructure and septal arrangement in a primitive Triassic Coral

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(manoscritto ricevuto il 25 gennaio 1974)

ABSTRACT — A research through optical and electron scanning microscope has been developed on more than 120 specimens of an Alpine Triassic single or phaceloid coral, here still named Protoheterastraea leonhardi *(Volz) (pars). The specimens are still preserved in their original mineralogical composition (aragonite, with high strontium content) and structure.*

Bilateral symmetry of septal insertion, peripheral insertion of septa two-by-two, absolute predominance of protosepta, no cyclic insertion of metasepta, are all characters more reliable to the late Paleozoic Rugosa than to the Scleractinia. On the other hand, no pinnate septal insertion occurs, as in Rugosa, and a theca is constantly present as an essential element of the skeleton.

Theca is given by aragonitic fibrolamellae, longitudinally finely folded. Contiguous, terminal surfaces of c-axes of aragonitic aggregates of contiguous fibrolamellae con knit together and give origin to a typical fibrous tissue.

Septa — discontinuous, frequently spiny and inwardly inclined — seem to have a fibrolamellar microstructure too: they seem to arise from a progressive infolding of thecal fibrolamellae. This structure cannot be relied either to the Rugosa or to the Scleractinia.

Further investigations are in course on the peculiar structure of Protoheterastraea leonhardi *(Volz) (pars).*

RIASSUNTO - [MICROSTRUTTURA E DISPOSIZIONE SETTALE IN UN CORALLO PRIMITIVO DEL TRIAS SUPERIORE] — *Un'indagine morfologica e microstrutturale mediante microscopio ottico e a scansione é stata effettuata su 120 esemplari di una specie che per il momento viene ancora ascritta provvisoriamente a* Protoheterastraea leonhardi *(Volz) (pars). Altri 50 esemplari trovati di recente (R. Zardini racc.) convalidano le presenti deduzioni.*

Un lavoro precedente, eseguito dall'A. e collaboratori, aveva dimostrato che lo scheletro di questa specie — come degli altri Scleractinia e di molte spugne provenienti dagli stessi affioramenti — é tuttora costituito da aragonite, con alto contenuto in stronzio, più o meno corrispondente allo stronzio contenuto in coralli ermatipici attuali. L'aragonite è in aggregati cristallini paralleli secondo l'asse z, casualmente disposti secondo gli altri due assi.

Lo studio morfologico e strutturale ha dato i seguenti risultati.

1. I setti sono rappresentati per lo più dai soli protosetti.

2. I protosetti hanno una disposizione spiccatamente bilaterale, con parametri costanti: setto cardinale più ridotto del controsetto, controalari più ridotti degli alari.

3. I setti hanno origine periferica.

4. I setti sono verticalmente discontinui, a volte ridotti a spine, a volte mancanti totalmente per lunghi tratti, lasciando la teca come unico elemento scheletrico.

5. I setti originano due a due, e non in numero di sei contemporaneamente, come è la regola. Qualunque sia il loro aspetto, essi immergono verso le regioni assiali.

6. I metasetti, quando presenti, sono irregolarmente distribuiti nei sestanti, cioè non hanno distribuzione ciclica né pinnata.