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**NEW STRATIGRAPHIC DATA
AND EVIDENCE OF LOWER AND UPPER DEVONIAN BASED
ON CONODONTS IN SARRABUS AREA
(Southeastern Sardinia)**

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Key-words: Biostratigraphy, Conodonts, Early Palaeozoic, Southeastern Sardinia.

Abstract. Upper Silurian, Lower and Upper Devonian conodonts are discovered for the first time from rare calcareous beds of the Serra S'Ilixi Group in the Pala Manna area, in connection with the nucleus of the "Sarrabus syncline" (southeastern Sardinia) where the youngest rocks of the Palaeozoic sequence of the Genn'Argiolas Unit crop out.

Consequently, clastic rocks of the conformably overlying Pala Manna Formation, also affected by the main Hercynian folding phase, could be considered Famennian-Lower Carboniferous in age. It also seems reasonable that the same rocks could be compared with the more or less coeval "Culm-type" clastic sediments of the Villasalto Conglomerate, in the nearby Gerrei region.

Riassunto. Nell'area di Pala Manna, nel nucleo della "sinclinale del Sarrabus" (Sardegna sud-orientale), dove affiorano i terreni più recenti della successione paleozoica dell'Unità di Genn'Argiolas, vengono per la prima volta segnalati conodonti del Siluriano superiore (Přidolí), Devoniano inferiore (Emsiano) e del Devoniano superiore (Frasniano-Famenniano basale), quest'ultimo finora del tutto inedito per il Sarrabus. I conodonti sono stati rinvenuti nei rari calcari presenti nella successione arenaceo-siltoso-pelitica con liditi del Gruppo di Serra S'Ilixi, dove finora erano stati riconosciuti il Siluriano inferiore ("Scisti neri" a Graptoliti del Llandovery) ed un probabile Devoniano inferiore e medio (Calcari a Tentaculiti) non ben documentato paleontologicamente.

Di conseguenza, i sedimenti clastici della sovrastante Formazione di Pala Manna, seguendo in continuità stratigrafica il calcare neodevonianico ora datato e risultando implicati nei principali piegamenti ercinici, dovrebbero avere un'età compresa nell'intervallo Famenniano-Carbonifero inferiore. Essi potrebbero quindi corrispondere alle clastiti eocarbonifere "tipo Culm" del vicino Gerrei (Conglomerato di Villasalto), anch'esse giacenti in concordanza sui potenti calcari del Devoniano superiore-Carbonifero basale (Tournaissiano inferiore).

Forword.

The Palaeozoic sequence of the Sarrabus region (Fig. 1, 2) is built up of a thick pelitic-arenaceous formation (San Vito Sandstones; Calvino, 1961) bearing acritarchs of Cambrian-Lower Ordovician age unconformably overlaid («Sarrabese unconformity») by arkose and conglomerates (Rio Ceraxa Conglomerate; Barca & Di Gregorio, 1980) and by an acid volcanic complex and

volcanoclastites («white porphyries» and «grey porphyries»; Calvino, 1961). Upper Ordovician fossiliferous sediments of Punta Serpeddi and Tuviois Formation (Barca & Di Gregorio, 1980) are transgressive on the underlying units. The sequence continues with the Serra S'Ilixi Group (Barca, 1981) consisting in its lower part of sandstones and black argillites bearing scattered Upper Llandovery graptolites (Teichmüller, 1931; Jaeger, 1977) with intercalations of lydites, tufites and, locally, conglomerates, and in the upper part of dark-grey siltites and pelites which are, apart from scattered trails and burrows, apparently barren. Rare lenses of fossiliferous limestone occur in the upper part of the group (1). These limestones have been considered to be Upper Silurian in age (Teichmüller, 1931) or Lower–Middle Devonian (Barca, 1981); the latter also reported two new small outcrops in the Serra is Luas area. However, no detailed palaeontological study was carried out on such limestones.

The Serra S'Ilixi Group is overlain by an approximately 100 m thick complex (Pala Manna Formation; Barca, 1981) consisting of cross bedded, locally micropuddingoid, sandstone followed by grey siltites and pelites. Near the base of the siltites some thin horizons of graded fine breccias, which are mainly formed by clasts of lydites floating in a ferruginous silty matrix, occur. Detritized, limonitized and very poorly preserved remains referable to brachiopods and possibly crinoids are also abundant components of the fine breccias.

This formation has been regarded by Teichmüller (1931) to be Downtonian–Gedinnian in age owing its stratigraphic position above the limestone cropping out in the locality of Pala Manna. Naud (1980b), considering the fossiliferous fine breccias similar to the horizons with Caradocian fossils of the Gerrei region, preliminarily regarded the clastites at the top of Pala Manna to be Upper Ordovician in age and tectonically superimposed on the underlying Silurian–Devonian rocks. Other authors (Barca & Di Gregorio, 1980; Barca, 1981) later supposed that the Pala Manna Formation might be referred to an Upper Devonian – Lower Carboniferous age on the basis of a possible stratigraphic boundary with the underlying Devonian limestones.

In order to get more detailed stratigraphic data chiefly on the Devonian–Lower Carboniferous rocks of Pala Manna area, the rare calcareous lenses have been tested for conodonts. The results of this study are therefore the main objective of the present report.

Structural outline.

Among the Hercynian nappes of southeastern Sardinia, Palaeozoic rocks of the Sarrabus region (or Genn'Argiolas Unit) represent the structurally highest tectonic unit (Carmignani, Costagliola et al., 1982). This unit, characterized

(1) Such lenses have been named Pala Manna Limestone by Barca and Mascia (1982, fig. IX.2) but, in order to avoid confusion with the Pala Manna Formation, it is better to neglect this name.

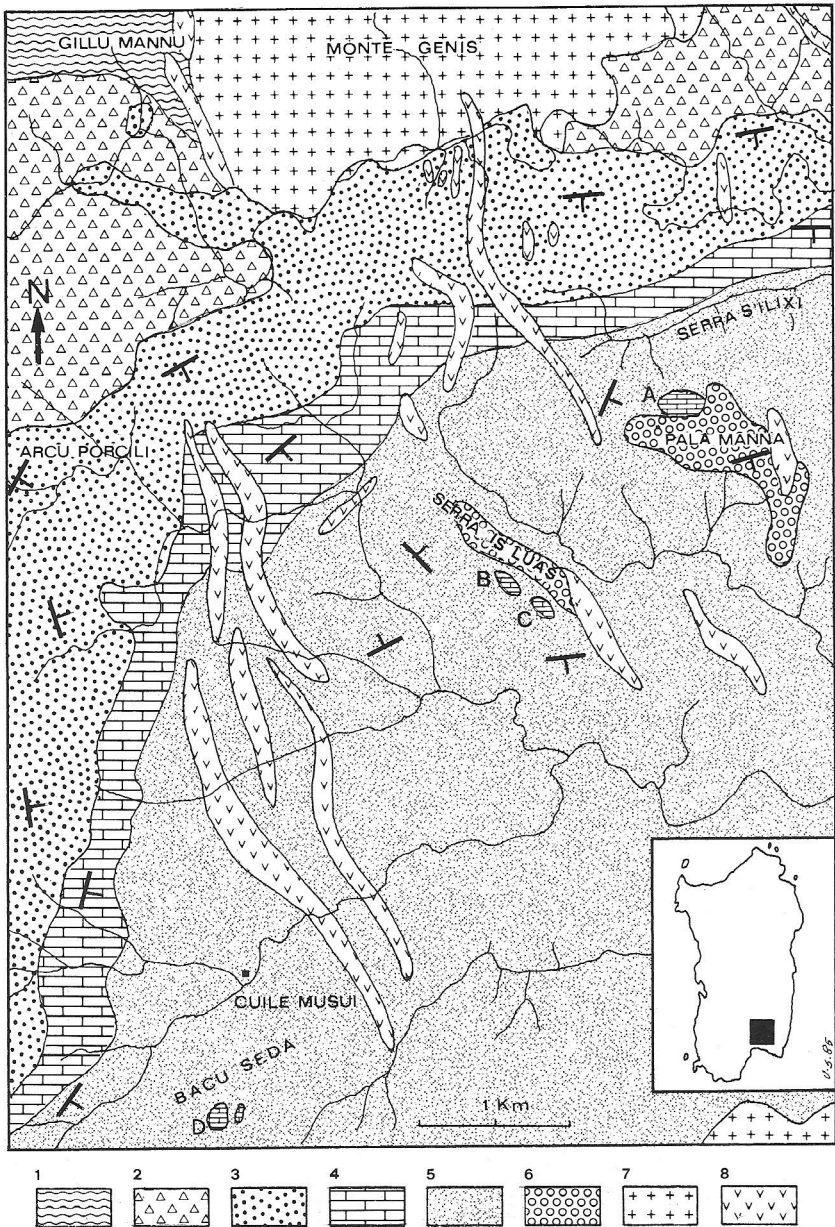


Fig. 1 – Geological map of the Pala Manna area (Sarrabus, SE Sardinia) and location of sampling sites. 1) San Vito Sandstones (Middle to Upper Cambrian – Lower Ordovician); 2) «Grey and White Porphyries» (Middle Ordovician); 3) Punta Serpeddì Formation (Caradoc – Ashgill); 4) Tuvióis Formation (Ashgill); 5) Serra S'Ilìxi Group (Lower Silurian to Upper Devonian); 6) Pala Manna Formation (Lower Carboniferous); 7) Hercynian granitoids; 8) Hercynian porphyries.

by a low metamorphic grade (epi-anchimetamorphism), overthrusts the more or less coeval Gerrei units from NE to SW (Fig. 2, 3) with a regional scale overthrust surface («Villasalto fault», Teichmüller, 1931; Calvino, 1967; «Villasalto overthrust», Carmignani & Pertusati, 1977); this was generated during the main Hercynian folding phase and afterwards refolded by late events. To the south of this important contact, further evidences of the Hercynian polyphase tectonics are, from North to South, the wide «Sarrabus anticline» whose nucleus is formed by the San Vito Sandstones and the adjacent «Sarrabus syncline» (Teichmüller, 1931) in whose wide nucleus the youngest rocks of the Sardinian Palaeozoic sequence outcrop: Silurian, Devonian and Lower Carboniferous of the Pala Manna area. Southward, this syncline is interrupted by the Hercynian intrusive mass of the southeastern part of the island (Fig. 3).

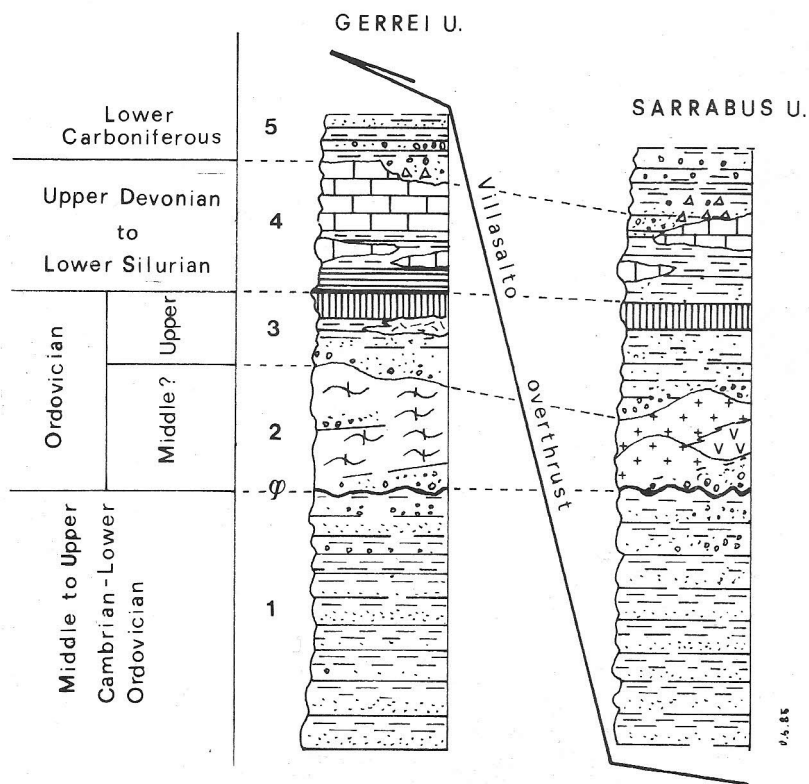


Fig. 2 — Stratigraphic columns (not to scale) of the Sarrabus and Gerrei Units. 1) San Vito Sandstones; φ) Angular unconformity of Sarrabese Phase; 2) Conglomerates and arkosic sandstones, Porphyroids (Gerrei U.), «Rio Ceraxa Conglomerate», «Grey and White Porphyries» (Sarrabus U.); 3) Conglomerates, sandstones and siltstones with spilites and generally silicified limestones (Punta Serpeddì Formation and Tuviois Formation of Sarrabus U.); 4) Black shales and limestones of Gerrei U. and Serra S'Ilìxi Group of Sarrabus U.; 5) Villasalto Conglomerate (Gerrei U.) and Pala Manna Formation (Sarrabus U.).

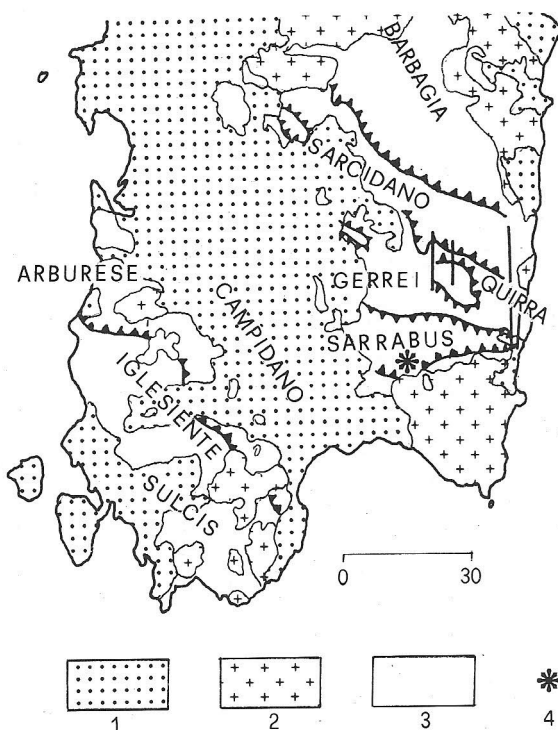


Fig. 3 — Simplified structural sketch—map of central—southern Sardinia. 1) Post—Palaeozoic sediments and volcanites; 2) Hercynian granitoids; 3) Palaeozoic metasediments and metavolcanites; 4) location of the studied outcrops.

New data.

Studied limestones are those outcropping in the localities of Pala Manna s.s. (A), Serra is Luas (B, C) and Bacu Seda (D) (Fig. 1).

Pala Manna s.s. (outcrop A). This is located northside hill 671, about 5 m above the old road that follows the Ollastu River in the neighbourhood of the old mines of Serra S'Ilixì. The section shows the upper part of Serra S'Ilixì Group composed by siltstones and dark grey pelites, which contain a big calcareous lens-shaped body with a maximum thickness of about 12 m (Fig. 4). Limestones, massive and light grey in colour, are represented by microbioclastic mudstone and bioturbated tentaculite wackestone—packstone with scattered undeterminable orthocone cephalopods, rare ostracodes and pelmatozoan fragments (levels 1, 1a). Subordinate thin layers of dark shales are interbedded with limestone. Toward the top of the section, the main lithology is represented by symsedimentary monogenic parabreccias with subangular to poorly rounded unsorted clasts floating with slumping structures in a black siltitic matrix (levels 2–4). A barite bed about 15 cm thick is also present inside the

breccias and it may be interpreted as a limited evaporitic sedimentary episode.

Eight samples of limestone, studied for conodont search, were particularly interesting and provided the following results.

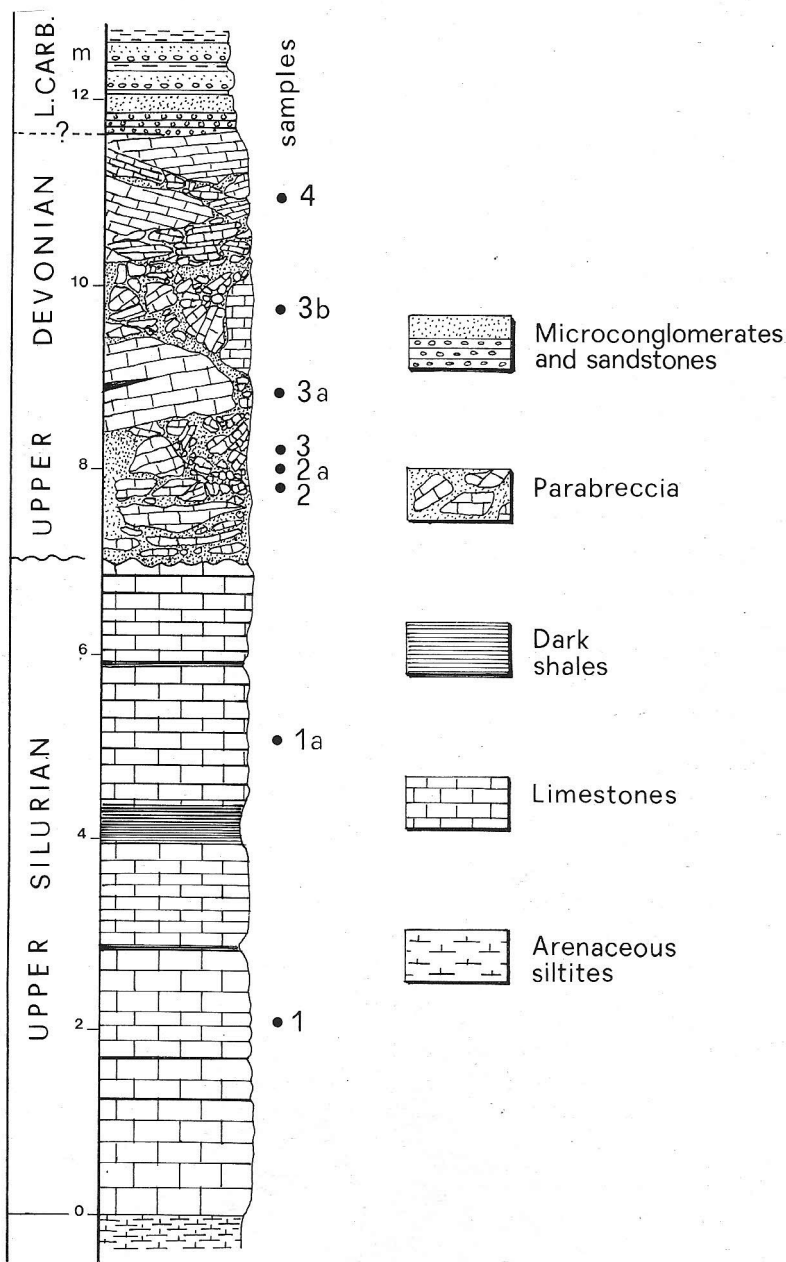


Fig. 4 — Lithostratigraphic log of the calcareous lens cropping out at Pala Manna s.s. locality with location of conodont samples.

Pala Manna (Sample 1; bedded limestone).

Ozarkodina excavata excavata (Branson & Mehl)

Oulodus elegans (Walliser)

Age. Upper Silurian.

Remarks. The presence of the complete apparatus of *O. elegans* excludes an age older than the Přidolí (Sweet & Schönlaub, 1975, p. 52). Some rare specimens of the form—species *Ligonodina* cf. *silurica* Branson & Mehl and *Pseudooneotodus bicornis* Drygant are also present.

Pala Manna (Sample 1a; bedded limestone).

Ozarkodina confluens (Branson & Mehl)

Ozarkodina excavata excavata (Branson & Mehl)

Age. Upper Silurian.

Remarks. Beside the two complete apparatuses above reported, some specimens of the form—species *Ligonodina silurica* (Branson & Mehl) and *Ligonodina elegans* Walliser are also present.

Pala Manna (Sample 2; parabreccia clast).

Ancyrodelloides aff. *transitans* (Bischoff & Sannemann)

Pandorinellina steinhornensis telleri (Schulze)

Ozarkodina wurmi (Bischoff & Sannemann)

Lonkodina walliseri Ziegler

Synprionodina sp.

Age of the clast. Lower Devonian (Lochkovian, *delta* Zone).

Pala Manna (Sample 2a; parabreccia clast).

Ancyrodelloides transitans (Bischoff & Sannemann)

Ozarkodina remscheidensis remscheidensis (Ziegler)

Pandorinellina steinhornensis telleri (Schulze)

Ozarkodina wurmi (Bischoff & Sannemann)

Beleodella sp.

Age of the clast. Lower Devonian (Lochkovian, *delta* Zone).

Remarks. Together with the Lochkovian fauna some Silurian «reworked» species of the *siluricus* Zone among which *Polygnathoides emarginatus* (Branson & Mehl) and the complete apparatus of *Ozarkodina confluens* (Branson & Mehl) also occur in the sample.

Pala Manna (Sample 3; matrix and parabreccia clasts).

Palmatolepis subrecta Miller & Youngquist

Polygnathus procerus Sannemann

Age. Upper Devonian (Frasnian).

Remarks. Of the two autochthonous species occurring in the sample, the precise stratigraphical distribution is known only for *Palmatolepis subrecta*, which ranges from the top of the Upper *asymmetricus* Subzone to the base of Middle

P. triangularis Subzone. In fact, *Polygnathus procerus* initially reported by Ziegler (1962) as having a continuous range from the Upper *P. triangularis* Subzone to the Upper *crepida* Subzone, has later been also found, even if sporadically, in older zones like *Ancyrognathus triangularis* (Mound, 1968), *asymmetricus* and *gigas* (Wang & Ziegler, 1983). Therefore, supposing this species to have a continuous range from *asymmetricus* Zone to Upper *crepida* Subzone, the concurrent interval of *Polygnathus procerus* and *Palmatolepis subrecta* is restricted to the Frasnian.

Together with the indigenous conodonts, some Lochkovian «reworked» species such as *Ancyrodelloides trigonicus* Bischoff & Sannemann, *A. kutscheri* Bischoff & Sannemann, *A. transitans* (Bischoff & Sannemann), *Ozarkodina remscheidensis remscheidensis* Ziegler, *Pandorinellina steinhornensis telleri* (Schulze) occur in the sample.

Pala Manna (Sample 3a; matrix and parabreccia clasts).

This sample did not produce any diagnostic conodont faunas.

The conodont assemblage in this level is dominated by Lochkovian forms like *Ancyrodelloides transitans*, *A. trigonicus*, *Ozarkodina stygia*, but both the co-occurrence of ramiform elements, probably belonging to the apparatus of *Polygnathus*, and the peculiar location of the sample let us hypothesize a Frasnian–Famennian age.

Pala Manna (Sample 3b; matrix and parabreccia clasts).

Palmatolepis delicatula delicatula Branson & Mehl

Age. Upper Devonian (Lower Famennian).

Remarks. The age of this sample ranges from the Middle *P. triangularis* Subzone to the Lower *crepida* Subzone. In fact, even if *Palmatolepis delicatula delicatula* has its lower occurrence and acme in the Middle *triangularis* Subzone, it also enters into the Lower *crepida* Subzone, as reported in Poland (Szulcowski, 1971) and Australia (Glenister & Klapper, 1966; Druce, 1976).

The only Upper Devonian species recovered is associated with numerous «reworked» specimens of Lochkovian age, among which *Ancyrodelloides trigonicus* Bischoff & Sannemann, *A. transitans* (Bischoff & Sannemann), *Pandorinellina steinhornensis telleri* (Schulze), *Pandorinellina optima* (Moskalenko), *Icriodus angustoides castilianus* Carls, are recognizable.

Pala Manna (Sample 4; matrix and parabreccia clasts).

Palmatolepis delicatula delicatula Branson & Mehl

Palmatolepis minuta minuta Branson & Mehl

Polygnathus procerus Sannemann

cf. *Ancyrognathus sinelamina* (Branson & Mehl)

Icriodus sp. (*alternatus* group)

Age. Upper Devonian (Lower Famennian).

Remarks. This level, because of the concurrence of *Palmatolepis delicatula delicatula* and *P. minuta minuta*, indicates an age between the Upper *P. triangularis* Subzone (where *P. minuta minuta* has its lowest occurrence) and the Lower *crepida* Subzone (where *P. delicatula delicatula* disappears).

Together with the autochthonous fauna some Lochkovian «reworked» species occur, such as *Ancyrodelloides transitans* (Bischoff & Sannemann), *Ozarkodina remscheidensis remscheidensis* (Ziegler), *Pandorinellina steinhornensis telleri* (Schulze) and *Ozarkodina stygia* (Flajs).

The abundant and excellently preserved conodonts of Lower Devonian age (Lochkovian, *delta* Zone) occurring in samples 3, 3b and 4 together with characteristic Upper Devonian forms are evidently reworked. This «reworking», however, is different from the classical concept normally attributed by palaeontologist to this event because the Lochkovian fauna clearly comes from the intraclasts of the synsedimentary breccias. In fact, sample 2 and 2a as well as some further isolated intraclasts (labeled MP α , MP β , MP γ , MP δ) obtained just below sample 2, only bear Lochkovian forms. Instead, it is more difficult to recognize the kind of reworking affecting the Silurian forms found in sample 2a.

On the basis of stratigraphic results from the study of the conodont faunas and of the lithological succession, it seems possible to subdivide the calcareous lens of Pala Manna into two different parts: a lower one of Upper Silurian age (sample 1, 1a), and an upper one of Upper Devonian age (Fig. 4). This, therefore, implied an important local erosional episode taking place during Middle Devonian time.

Serra is Luas (outcrops B and C). About 2 km SW of Pala Manna on the southwestern slope of the hill named Serra is Luas and just below the top of the hill, new outcrops have recently been discovered. Outcrops, 2–3 m thick and about 200 m far apart, are made up of grey pelagic limestones mainly represented by bioturbated tentaculite wackestone—packstone. Rare orthocone cephalopods and pelmatozoan ossicles are also present. The limestones are interbedded with aqua—grey, blue and dark siltstones apparently devoid of fossils.

Two samples of limestone, collected from the two different outcrops, have been processed and yielded stratigraphically significant conodonts.

Serra is Luas B.

Polygnathus linguiformis bultyncki Weddige

Polygnathus serotinus Telford

Ozarkodina carinthiaca (Schulze)

Pandorinellina steinhornensis steinhornensis (Ziegler)

Pseudooneotodus beckmanni (Bischoff & Sannemann)

Age. Lower Devonian (Dalejan, *serotinus* Zone).

Remarks. Both polygnathids occurring in the assemblage range from the *serotinus* Zone to *costatus costatus* Zone, but the occurrence of *Pandorinellina steinhornensis steinhornensis* (Ziegler) restricts the age of the level to the *serotinus* Zone. Ziegler's species, in fact, has its upper boundary inside the *serotinus* Zone either in the Barrandian area or in Central Asia (Zeravshan range), as reported by Klapper and Ziegler (1979, text—fig. 2) and Klapper and Johnson (1980, tab. 6).

Several rare ramiform elements probably belonging to the apparatus of *Polygnathus*, *Ozarkodina* and *Pandorinellina* are also present in the assemblage.

Serra is Luas C.

Polygnathus gronbergi Klapper & Johnson

Polygnathus dehiscens Philip & Jackson

Polygnathus sp.

Pandorinellina steinhornensis miae (Bultynck)

Pandorinellina steinhornensis steinhornensis (Ziegler)

Pelekysgnathus sp.

Icriodus cf. *bilatericrescens* Ziegler

Belodella sp.

Pseudooneotodus beckmanni (Bischoff & Sannemann)

Age. Lower Devonian (Zlichovian, *gronbergi* Zone).

Remarks. This is a very interesting sample bearing several species of particular significance for the biostratigraphy of the Lower Devonian. *Polygnathus gronbergi*, for instance, clearly indicates the homonymous zone. Furthermore, the co-occurrence of *P. dehiscens* allows the age of this sample to be restricted to the lower part of the same *gronbergi* Zone.

In this assemblage few and poorly preserved neoprioniodiform, diplodelliform, hindeodelliform and triconodelliform elements also occur, probably belonging to the apparatus of *Polygnathus*, *Pandorinellina* and *Ozarkodina*.

Bacu Seda (outcrop D). This is the last new outcrop recently discovered and it is located about 6 km SSW of Pala Manna. It consists of a dark-grey limestone, interbedded with black siltstones bearing lydites and Silurian graptolites, which have been reported near Cuili Masui (Teichmüller, 1931).

Because the limestone is more or less recrystallized and mineralized (sulfate and oxide skarn), the studied samples have yielded rare and poorly preserved conodonts of little stratigraphic significance.

The form-species identified (*Trichonodella* cf. *excavata*, *Plectospathodus extensus*, *Hindeodella* sp., *Spathognathodus* sp.) allow us to hypothesize an interval close to the Upper Silurian and Lowermost Devonian.

Examination of Conodont Colour Alteration Index (CAI) in all studied samples shows a value of 5–6 for both autochthonous and «reworked» speci-

mens. Such value indicates heating in excess of 300–400 C°, principally caused by the intrusive Hercynian mass of Mt. Settefratelli cropping out in the extreme southeastern part of the island, not far from the studied area.

Conclusions.

The present investigation, based mainly on conodont fauna, gives new and interesting data on the stratigraphy of the Palaeozoic of the Sarrabus region.

We are, in fact, able for the first time to document the Lower Devonian (Serra is Luas and Pala Manna outcrops) and Upper Devonian (Frasnian—Lower Famennian; Pala Manna outcrop) in the studied area. This last discovery is of particular interest since it allows us to regard the upper part of the Serra S'Illici Group as younger than until now supposed. Consequently, the clastic rocks of the Pala Manna Formation (Barca, 1981), also affected by the main Hercynian folding phase, can be regarded as Lower Carboniferous.

More detailed stratigraphic correlation with other areas of the island is now possible. Particularly interesting is the comparison of the studied area with that at Gerrei. Here the Middle—Upper Devonian as well as the Lowermost Carboniferous (limestones bearing conodonts of Lower Tournaisian age, Olivieri, 1970) are mainly represented by limestones conformably overlyed by Upper Carboniferous Villasalto conglomerate, mainly build up of siltstones, parabrecias, polymictic conglomerates with Lower Devonian calcareous clasts, lydites, etc. (Teichmüller, 1931; Spalletta & Vai, 1982; Barca & Spalletta, 1984). It thus seems likely that the Devonian of the Sarrabus region, mostly represented by terrigenous rocks and only episodically calcareous rocks, could be related to a sedimentary basin very close to the carbonate platform of the Gerrei region, which was presumably located northeastward. This was the inferred geographic location of the Sarrabus and Gerrei areas before the extensive Hercynian shortenings, caused by the wide regional overthrusts acting from northeast toward the southwest (Carmignani, Costagliola et al., 1982; Naud, 1982).

Displacement of the Devonian—Lower Carboniferous platform as well as of the surrounding areas, due to distensive synsedimentary tectonics beginning as soon as at the Upper Devonian, may have originated subsiding basins and structural highs. Quick terrigenous deposition associated with resedimentation (breccias, slumpings, debris—flows, etc.) and strong erosional processes were active in the two areas, respectively. The last processes, in particular, may have eroded old formations, as evidenced by the occurrence of Lower Devonian carbonatic clasts (bearing conodonts) in the parabreccia levels of the limestone at Pala Manna s.s. locality as well as by the Silurian lyditic clasts and Precaradocian porphyris in the Villasalto Conglomerate.

To conclude, at the present state of our knowledge, the Pala Manna Formation and Villasalto Conglomerate in the Sarrabus and Gerrei regions respecti-

vely, may represent the only evidence of terrigenous Lower Carboniferous (Sardic Hercynian Flysch) recognized to date in central and southern Sardinia. The «Postgotlandiano» *Auctorum* of southwestern Sardinia (Sulcis, Iglesiente and Sarrabus regions) is, in fact, presently regarded as having a Cambrian–Lower Ordovician age on the basis either of recently discovered acritarchs or lithostratigraphic and structural features which are identical to those exhibited by the Cambrian–Lower Ordovician formations (San Vito Sandstones, Solanas Fm.) extensively cropping out in southeastern Sardinia (Barca, Del Rio & Pittau, 1981).

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PLATE 29

- Fig. 1 – *Polygnathus serotinus* Telford. Serra is Luas, outcrop B. a, b) Lower and upper views of the same specimen; x 55.
- Fig. 2 – *Polygnathus gronbergi* Klapper & Johnson. Serra is Luas, outcrop C. a, b) Lower and upper views of the same specimen; x 92.
- Fig. 3–5 – *Polygnathus dehiscens* Philip & Jackson. Serra is Luas, outcrop C. 3a, 4b, 5a) Upper views of three specimens; 3b, 4a, 5b) lower views of the same specimens; x 92.
- Fig. 6 – *Polygnathus linguiformis bultyncki* Weddige. Serra is Luas, outcrop B. Oblique-view; x 92.

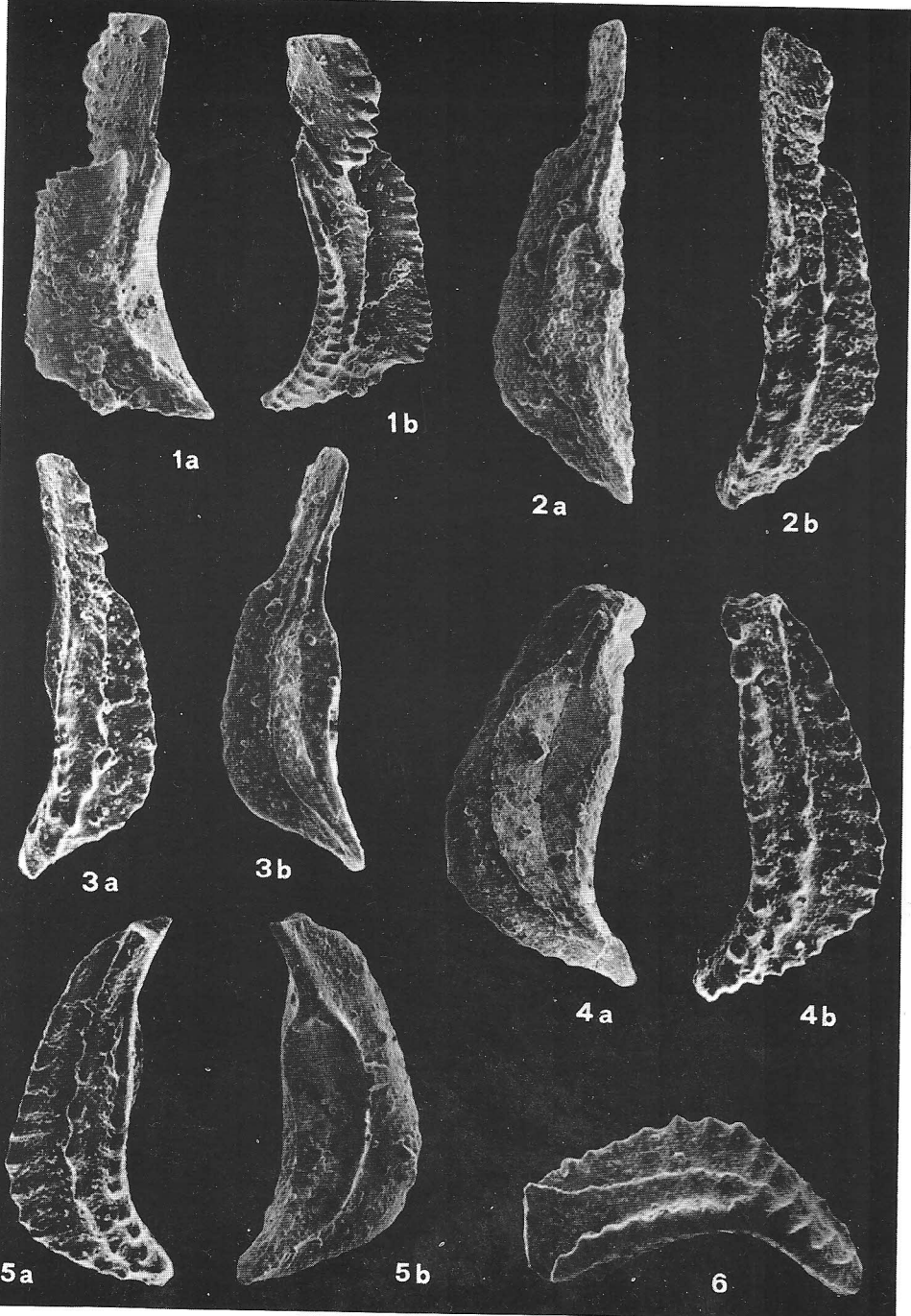


PLATE 30

- Fig. 1 — *Palmatolepis minuta minuta* Branson & Mehl. Pala Manna, sample 4. Upper view; x 60.
- Fig. 2 — *Palmatolepis subrecta* Miller & Youngquist. Pala Manna, sample 3. Upper view; x 60.
- Fig. 3–5 — *Palmatolepis delicatula delicatula* Branson & Mehl. Pala Manna, sample 3b. 3, 4) Upper views; x 60. Pala Manna, sample 4. 5) Upper view; x 100.
- Fig. 6 — *Polygnathus procerus* Sannemann. Pala Manna, sample 4. Oblique–lateral view; x 60.
- Fig. 7–9 — *Pandorinellina steinhornensis miae* (Bultynck). Serra is Luas, outcrop C. 7, 9) Upper views; 8) oblique–lateral view; x 60.
- Fig. 10–13 — *Pandorinellina steinhornensis steinhornensis* (Ziegler). Serra is Luas, outcrop C. 10–12) Upper views; 13) oblique–lateral view; x 55.

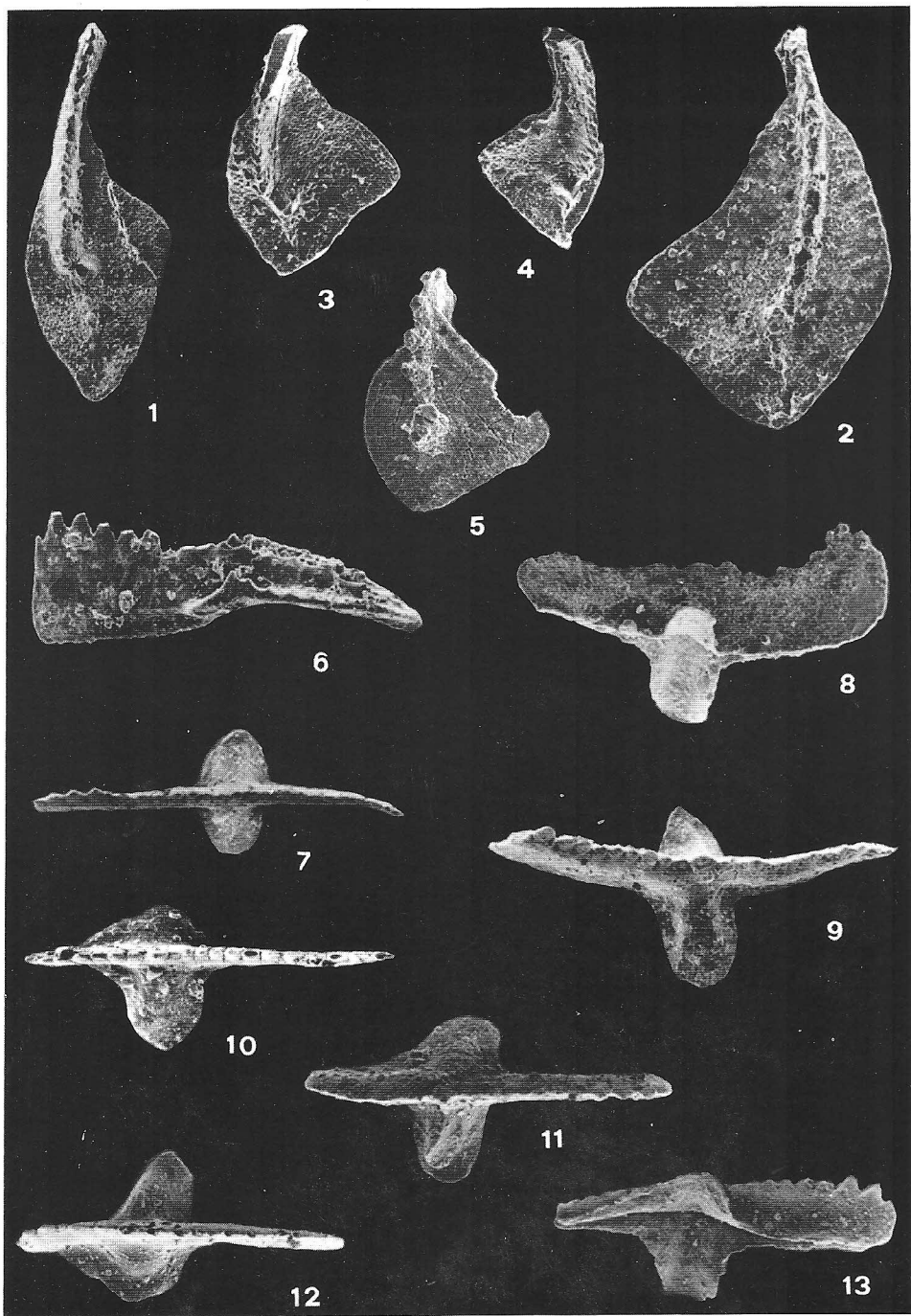


PLATE 31

The specimens of fig. 1–8 are Early Devonian species «reworked» in Late Devonian levels.

- Fig. 1, 5 – *Ancyrodelloides trigonicus* Bischoff & Sannemann. Pala Manna, sample 3a. 1) Upper view; x 40. Pala Manna, sample 3. 5) Upper view; x 60.
- Fig. 2, 3 – *Ozarkodina stygia* (Flajs). Pala Manna, sample 4. Upper views; x 92.
- Fig. 6 – *Ancyrodelloides transitans* (Bischoff & Sannemann). Pala Manna, sample 3. Upper view; x 60.
- Fig. 4, 7 – *Ancyrodelloides kutscheri* Bischoff & Sannemann. Pala Manna, sample 3. Upper views; x 60.
- Fig. 8 – *Icriodus angustoides castilianus* Carls. Pala Manna, sample 3b. Upper view; x 40.
- Fig. 9, 10 – *Ozarkodina carinthiaca* (Schulze). Serra is Luas, outcrop B. 9a, b) Oblique–lateral and lateral views of the same specimen; x 70; 10) upper view; x 60.

