

The type-section of the Iglesias Group (SW Sardinia, Italy)

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LOCALITY	Cabitza-Campo Pisano area, about 2 km from the centre of Iglesias.
STRATIGRAPHIC UNIT	San Giovanni, Campo Pisano and Cabitza Formations.
AGE	Latest Lower Cambrian to Early Ordovician, <i>Protolenus</i> till <i>Rhabdinopora flabelliformis</i> Zone.

LOCATION

The composite type sections of the Campo Pisano and Cabitza Formations have been defined in the easternmost part of the tectonic structure known as “Cabitza syncline”, between the abandoned railway Cabitza station, the new by-pass road (S.S. N.130) and the closest hills, further to the south, near Case Cabitza (Pillola, 1989, 1994) (Fig.1). These outcrops represent the best-known uppermost Lower Cambrian to Tremadocian succession in SW Sardinia.

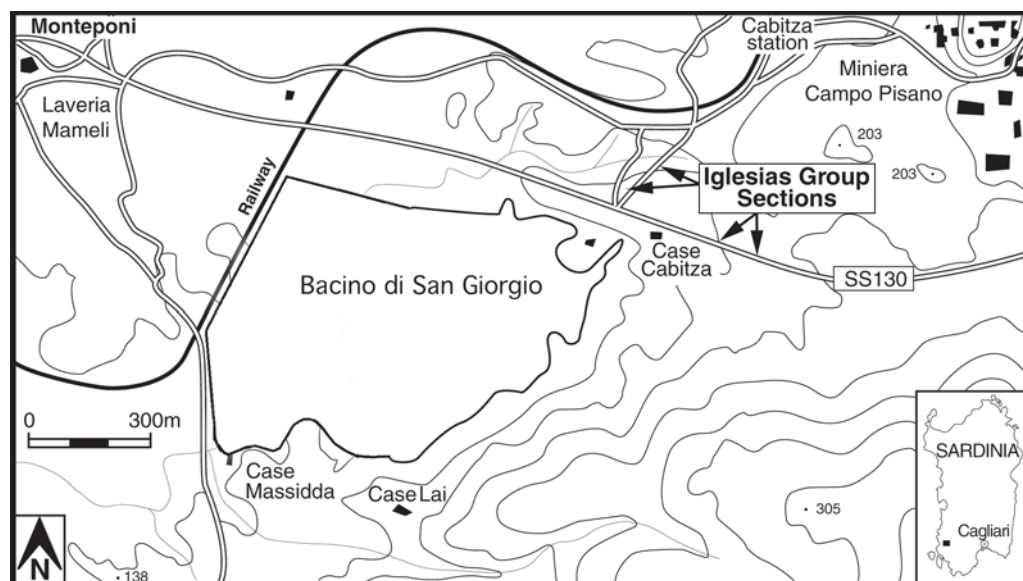


Fig. 1 - Simplified topography and location of the stops in the Campo Pisano-Cabitza area. (After Loi *et al.*, 1995, mod.).

HISTORICAL OUTLINE

The biostratigraphical data from this area concerns the microfossils remains (Cherchi & Schroeder, 1985; Mostler, 1985), and mainly by trilobite records (Di Stefano, *in* Gambera, 1897; Pompeckj, 1901; Rasetti, 1972; Gandin & Pillola, 1985; Pillola, 1986, 1989, 1991a, 1991b, 1994; Pillola & Leone, 1993). Sedimentary features of the Campo Pisano and Cabitza Formations have been described by Boni & Gandin (1980); Gandin (1980); Gandin & Pillola (1985); Bechstadt *et al.*, (1994); Loi *et al.*, (1995, 1996); Pillola *et al.* (1998).

THE CAMPO PISANO AND LOWER CABITZA FORMATIONS

The section is exposed in the by-pass road cut SS 130, about 450 m south of the abandoned Cabitza railway station (Fig. 1). The Campo Pisano Formation overlies the “dolomia grigia”, which is constituted of more or less silicified fine grained dolomites (Gandin, 1980).

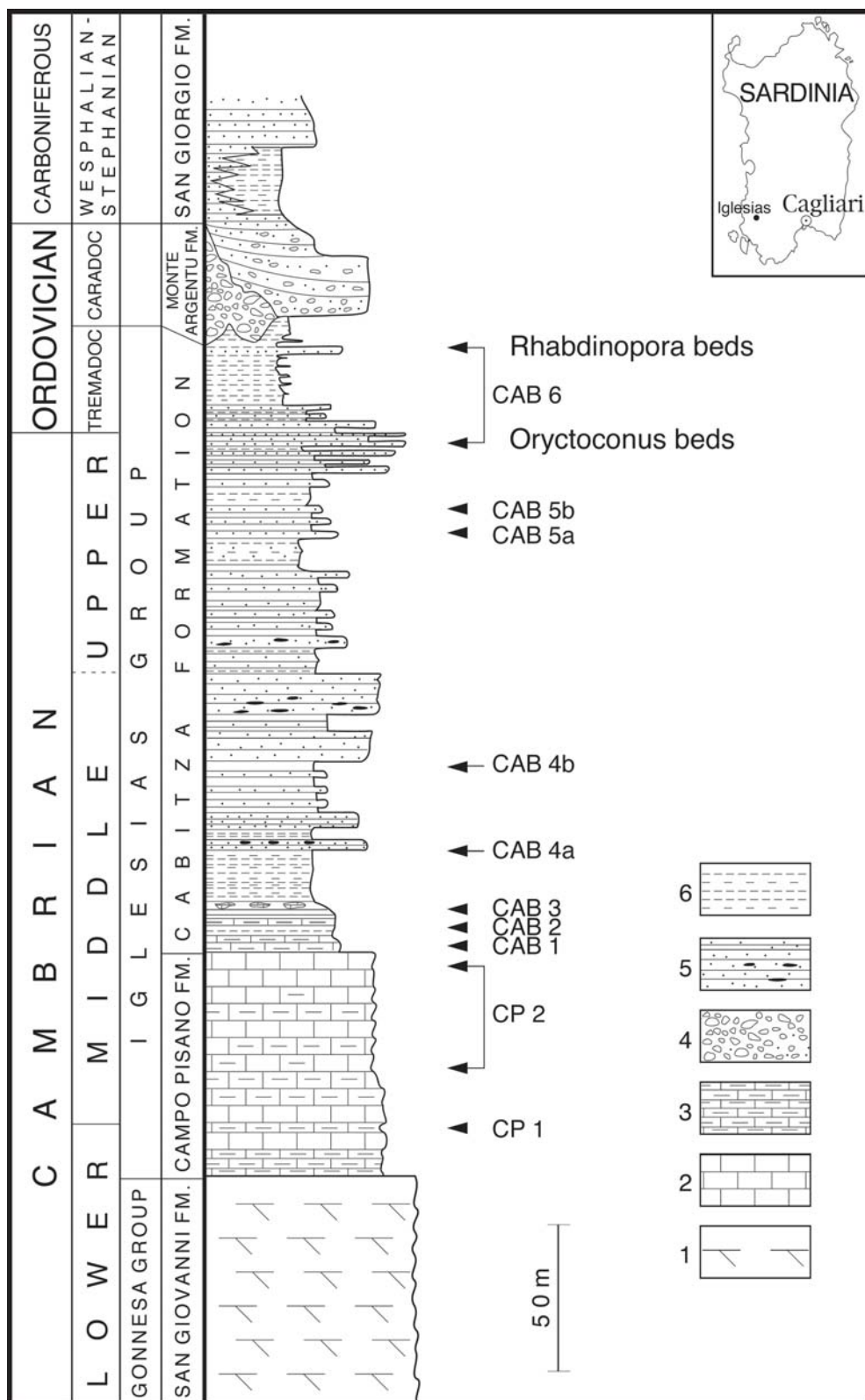
The succession is about 80 m thick (Fig. 2) with the lowest 20 m mainly composed of alternation of marls with dispersed, often dolomitised nodules (3-5 cm in size), and of grey silty-shaly beds as well as weathered, massive marls. This lower part of the sequence is overlain by grainstone lenses (mainly echinoderm debris) and by 50 m thick succession of nodular limestone (nodules 0.5 to 3 cm in size) with yellowish, light-green or pink-violet, terrigenous material. The top of the Campo Pisano Formation is characterised by white to light-grey, massive limestone.

Few trilobites and brachiopods occur in the lower 20 m (CP1 assemblage). The overlying part of the section is very fossiliferous (CP2 assemblage), but, except for microfossils, no larger remains can be extracted. The transition to the Cabitza Formation was well exposed in a track cut a dozen metres toward the north, and at the base of the mine big dump. Fossiliferous marls and weathered marly limestones (two m thick) are overlain by pink-ochraceous unfossiliferous marls and dark grey-yellowish siltstones (2,5 m). The fossiliferous marls contain, together with echinoderms plates, the following trilobite taxa (CAB-1 fauna): *Solenopleuropsis ribeiro* (De Verneuil & Barrande 1860), *Ctenocephalus* (*Ctenocephalus*) sp. and *Paradoxides* sp..

The overlying thick bedded, white-beige marls and weathered marly limestones (2,5 m) contain well-preserved fossils (CAB-2 assemblage). The following trilobites have been found: *Paradoxides* (*Eccaparadoxides*) cf. *pusillus*, *Paradoxides* (*Eccaparadoxides*) *mediterraneus* Pompeckj 1901, *Paradoxides* (*Eccaparadoxides*) *brachyrachis* Linnarson 1883, *Conocoryphe* cf. *brevifrons* Thoräl 1948, *Conocoryphe* sp., *Peronopsis* sp., *Corynexochus* and unassigned agnostids. Echinoderms are represented by *Decacystis*, *Gyrocyrtis* and “*Eocystites*”.

The overlying red-violet siltstones and shales (5 m), with rare nodules or small calcareous lenses (about 20 m to the north), yield the bulk of the CAB-3 assemblage. The following trilobites have been found: *Paradoxides* (*E.*) *mediterraneus*, *Paradoxides* (*E.*) *brachyrachis*, *Conocoryphe* *brevifrons* Thoräl 1948, *Conocoryphe* sp., *Jincella prantli* (Ruzika 1944), *Liosolenopleura* cf. *serventi* Thoräl 1948, *Ctenocephalus* (*Harttella*) cf.

Fig. 2 – Schematic sequence of the Iglesias Group in the Campo Pisano-Cabitza area: 1. dolomites resulting from the San Giovanni Formation; 2. limestones, 3. marly and nodular marly limestones; 4. conglomerates; 5. sandstones and coarse siltstones; 6. siltstones and shales. Note: the Monte Argentu and the San Giorgio Formations are not in scale.



terranovicus, *Bailiella* sp., *?Elyx* sp., *Anopolenus* cf. *henrici*, *Peronopsis* cf. *fallax*. Echinoderms are again represented by *Decacystis*, *Gyrocystis* and *Ceraticistis*; rare brachiopods and trace fossil can be found. Unfragmented strongly distorted carapaces are not rare; however most of the fossils are randomly dispersed or concentrated in few layers.

The following CAB-4 informal assemblage has been previously considered to be Middle Cambrian in age; however, the trilobite fauna, composed of *Paradoxides* (*Macrocerca*) cf. *macrocercus*, *Jincella* sp. and *Agraulos* sp., is confined to the lower part of the CAB-4 (here C4a), clearly identified only in 15-18 metres of grey-green siltstones in the Cabitza area. In higher levels, only unidentified debris was collected in correspondence of dissolved marly or in thin sandy layers between the old Cabitza railway station and the hill located near Case Cabitza. In recent times, the first violet brownish, deposits showing dissolution voids (CAB-4b) within the sandy beds of the CAB-4 succession, have yielded *Prochuangia* sp., *Koldinioidia* sp. and two unassigned taxa, and acrotretaceans brachiopods.

UPPER CAMBRIAN CAB-5 ASSOCIATION WITHIN A TIDE-DOMINATED DELTA ENVIRONMENT

The section (Loi *et al.*, 1995) is located in correspondence of a pipe line excavation close to the old railway (Fig. 1); the sedimentary features and the position of the fossiliferous beds CAB 5a and CAB 5b, belonging to the CAB-5 association, can be observed.

Four main facies have been distinguished in the Upper Cambrian and early Tremadoc sequence (Loi *et al.*, 1995, 1996):

Facies 1 - sandy siltstones with ripple-drift cross-lamination

Facies 2 - laminated shales and fine sandstones

Facies 3 - HCS sandstones and planar to weakly inclined lamination in supercritical flow

Facies 4 - shales and siltstones "graded rhythmites"

We can observe the delta tide dominated deposits characterised by the structures observed in facies 1 and 2 and their vertical evolution.

The beds are overtuned and plunge 70° towards SE; typical alternating red and green colour is displayed.

The section is continuously exposed for about 30 m; in detail, we can observe: at 11 m from the base the fossiliferous CAB 5a beds (only brachiopods) and, just below, the manganiferous bed; at 22 m from the base the CAB 5b beds (yielding trilobites, hyolithids and rare echinoderms). Facies 1 and 2 characterise this lower part of the sequence.

THE ACEROCARE REGRESSIVE EVENT AND THE CAMBRO-ORDOVICIAN BOUNDARY

The best exposure of this portion of the Cabitza section crop out in an excavation close to the by-pass road and the pipe line crossing.

In the south-western side of this excavation, sandstones beds, with silty-clayey intercalations, shows extended load-casted basal surfaces. These sandstones contain abundant often dissolved bioclasts.

In the north-eastern side several sedimentary features can be observed (facies 3 and 4). Particularly relevant is the presence of several sandstones levels with HCS, carbonatic layers (bioclastic dominated) and, in the upper part, the transition to the graded rhythmites.

Upward the sequence contains several red dominated beds as intercalations within the largely represented green-grey graded rhythmites facies, well exposed on the main road cuts. However, the strongly complicated tectonic setting does not allow a safe measurement of the section. The first reddish intercalation yields at Case Lai several colonies of *Rhabdinopora flabelliformis* and trace fossils.

Finally, in this area, reduced outcrops of the Monte Argentu Formation and of the Upper Carboniferous (San Giorgio Formation) are exposed westernly (see Del Rio *et al.*, 2002).

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REFERENCES

- BECHSTÄDT, T., BONI, M., & FRÖHLER M., 1994, Facies development in early and middle Cambrian time: In Bechstädt, T. & Boni, M. (Eds), *Sedimentological, stratigraphical and ore deposits field guide of the autochthonous Cambro-Ordovician of southwestern Sardinia*: Mem. Descr. Carta Geol. d'It., 48: 47-106.
- BONI, M. & GANDIN, A., 1980, Analisi sedimentologica e giacimentologica del passaggio Formazione di Gonnessa-Formazione di Cabitza del Cambriano sardo: Mem. Soc. Geol. It., 20 (1979): 453-459.
- CHERCHI, A. & SCHROEDER, R., 1985, Middle Cambrian foraminifera and other microfossils from SW Sardinia. Boll. Soc. Paleont. Ital., 23(2), (1984): 149-160.
- DEL RIO, M., PILLOLA, G. & MUNTONI, F., 2002, The Upper Carboniferous of the San Giorgio Basin. In Cherchi, A., Corradini, C. & Putzu, M.T. (Eds), *Sardinia Field Trip - Palaeontology & Stratigraphy*: Rend. Soc. Paleont. Ital., 1, 223-229.
- GAMBERA, V., 1897, Relazione sulla scoperta di fossili nell'Iglesiente: Ass. Min. Sarda, 2(2): 5-6.
- GANDIN, A., 1980, Analisi sedimentologica preliminare della parte superiore della Formazione di Gonnessa e della parte inferiore della Formazione di Cabitza (Cambriano inferiore e medio della Sardegna): Mem. Soc. Geol. It., 20 (1979): 395-404.
- GANDIN, A. & PILLOLA, G.L., 1985, Biostratigrafia e sedimentologia della Formazione di Cabitza nell'Iglesiente: In Gruppi di lavoro del CNR: "Paleozoico" e "Evoluzione magmatica e metamorfica della crosta fanerozoica". Riunione Scientifica, Siena 13-14 Dicembre, 1985: 30-31.
- LOI, A., PILLOLA, G.L. & LEONE, F. 1995, The Cambrian and Early Ordovician of south-western Sardinia: In Cherchi, A. (Ed.), 6th Paleobenthos International Symposium, Sardinia, October, 25-31, 1995. Rend. Sem. Fac. Sci. Cagliari, 65 suppl.: 61-81.
- LOI, A., PILLOLA, G.L. & LEONE, F. 1996, La limite Cambrien-Ordovicien dans le SW de la Sardaigne: relations avec des événements eustatiques globaux: C. R. Acad. Sci. Paris, 323, Sér. II: 881-888.
- MOSTLER, H., 1985, Neue heteractinide Spongien (Calcspongea) aus dem Unter- und Mittelkambrium Südwestsardiniens: Ber. nat. med. Verein Innsbruck. 72: 7-32.
- PILLOLA, G.L., 1986, Biostratigraphy of the Campo Pisano and Cabitza Formations. Preliminary report. IGCP Project n° 5: Correlation of Prevariscan and Variscan Events in the Alpine Mediterranean Mountain Belts: Final Meeting, Sardinia, may 25-31, 1986: 33-34.
- PILLOLA, G.L., 1989, Données lithologiques et stratigraphiques sur le Cambrian et le Tremadoc de l'Iglesiente (SW de la Sardaigne): In Sassi, F.P. & Bourrouilh, R. (Eds), IGCP Project No. 5, Correlation of Prevariscan and Variscan Events of the Alpine-Mediterranean Mountain Belt: Newsletter, 7: 228-239.
- PILLOLA, G.L., 1991a, Occurrence of *Proteuloma* (Trilobita) in the Cabitza Formation (Cambro-Tremadoc, SW Sardinia, Italy): Palaeobiogeographic implications: In Cappelli, B. & Liotta, D. (Eds), *Geologia del Basamento Italiano*, Convegno in memoria di Tommaso Cocozza, Siena 21-22 marzo 1991: 59-61.
- PILLOLA, G.L., 1991b, Trilobites du Cambrien inférieur du SW de la Sardaigne, Italie. Palaeontogr. Ital., 78: 1-174.
- PILLOLA, G.L., 1994, The Cambro-Ordovician of southwestern Sardinia: Trilobite biostratigraphy and palaeobiogeographical affinities: In Bechstädt, T. & Boni, M. (Eds), *Sedimentological, stratigraphical and ore deposit Field Guide of the autochthonous Cambro-Ordovician of Southwestern Sardinia*: Mem. Descr. Carta Geol. d'It., 48(1): 19-28.
- PILLOLA, G.L. & LEONE, F., 1993, Biostratigraphical and sedimentological data from the Cabitza Formation (Middle Cambrian-Tremadoc, SW Sardinia, Italy), palaeogeography and Cambro-Ordovician Boundary: I.G.C.P. 319, Liverpool: 22.
- PILLOLA, G.L., LEONE, F. & LOI, A., 1998, The Cambrian and Early Ordovician of SW Sardinia: Giorn. Geol., ser. 3, vol. 60, 1998, Spec. Issue, ECOS VII, Sardinia Guide-Book: 25-38.
- POMPECKI, J.F., 1901, Versteinerungen des *Paradoxides*-Stufe von La Cabitza in Sardinien und Bemerkungen zur Gliederung des Sardischen Cambrium: Zeitschr. Deutsch. Geol. Gesell., 53: 1-23.
- RASETTI, F., 1972, Cambrian trilobites faunas of Sardinia: Atti Acc. Naz. Lincei, Cl. Sci. Fis. Mat. e Nat., Mem., ser. 8, 11, sez. 2.: 1- 100.