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Highly tectonized Silurian and Lower Devonian sediments at Funtanamare (SW Sardinia)

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LOCALITY on the western coast of Sardinia, about 2.3 km South of Nebida, at geographic coordinates 39°17'30"N, 8°26'20"E.

LITHOSTRATIGRAPHIC UNITS Fluminimaggiore Fm. and Mason Porcus Fm.

AGE Sediments from Late Ordovician to Early Devonian are discontinuously exposed here. Triassic and Quaternary covers are also visible.

WHAT TO SEE highly tectonized Silurian and Devonian sediments.

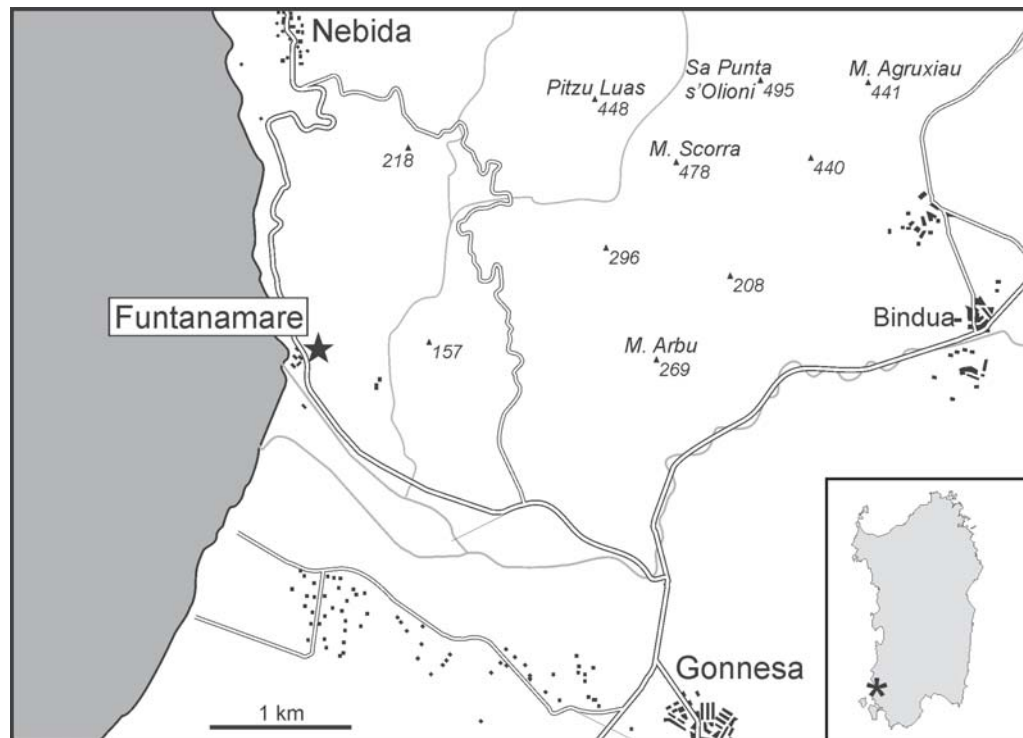


Fig. 1 - Location map of the Funtanamare outcrops.



Fig. 2 - Main exposure of the Mason Porcus Fm. at Funtanamare.

HOW TO GET THERE

The outcrops are very close to the Funtanamare village, along the Gonnese-Nebida coastal road.

HISTORICAL OUTLINE

Even if stratigraphical data from these limestones have been available for several years, the Funtanamare locality is described for the first time in this paper. A paratype of *Kockelella variabilis ichtnusae* from this outcrop was illustrated by Serpagli & Corradini (1999) in their revision of Genus *Kockelella*, and a few bivalves were illustrated by Kriz & Serpagli (1993).

LITHOLOGY

Despite the complicated tectonic settings, a peculiar Upper Ordovician - Lower Devonian succession is here exposed.

The main Upper Ordovician deposits exposed in the Funtanamare outcrop are represented by an alternation of fine sandstones, siltstones and weathered marly massive levels, containing a rich bryozoan fauna, accompanied by less frequent brachiopods and unusually abundant gastropods.

The uppermost ?Ordovician levels are represented by grey-greenish sandy siltstones and shales, followed by squeezed black shales and scattered remains of marly limestones, usually yellow in surface, with clear alteration processes. These beds (Fluminimaggiore



Fig. 3 - Unassigned cyrthoconic nautiloid (Funtanamare, Mason Porcus Fm.).

Fm.), up to 20 cm thick, may locally contain cephalopods. In several places these disconnected beds are close to thinly bedded black limestones, containing nautiloids, and dark shales. Upwards, the succession shows more and more thin limestone levels, still alternating with bleached marls and shaly deposits. The transition with the massive nodular limestones of the Mason Porcus Fm. appears gradual but new studies are in progress. The thickness of the entire Fluminimaggiore Fm. can be only estimated, and seems to reach 3-4 metres.

The Mason Porcus Fm. (Fig. 2) is mainly represented by massive well bedded nodular limestones and marly limestones, grey in colour, with yellow to reddish alteration of the marly portions. In exposed surfaces there is evidence of nautiloid profiles (Fig. 3), few crinoidal remains and dacryoconarids. The maximum thickness of the Mason Porcus Fm. is here about 7 metres.

Close to the main Silurian-Devonian outcrops, the ?Permian-Triassic red sandstones and conglomerates, and the middle Triassic silty-clayey dolomites and limestones are well exposed on extensive tilted plateaux and cliffs while Eocene deposits crop out few metres towards the East.

Quaternary covers, mainly aeolian sandstones, disconformably overlie the older units in the lower part of the area around the Silurian and Devonian outcrops, also include marine fossiliferous deposits close to the present day beach (Pleistocene, Thyrrenian stage) and palaeosoils, while breccias characterize higher portions of the slope.

Finally, the closest cliffs formed by the Triassic deposits towards the East, were inhabited by the early Sardinians, during the Copper Age.

FOSSIL CONTENT

A very few trilobites have been found during the preparation of this stop. They are the first trilobites ever illustrated from the Silurian of Sardinia (Fig. 4). The paucity of available

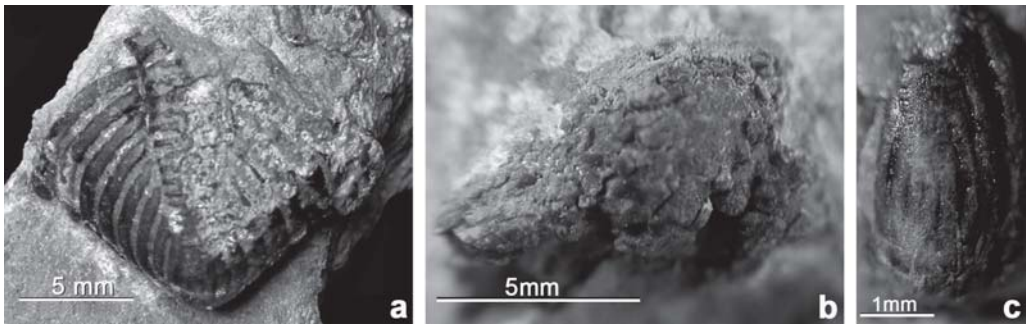


Fig. 4 - Encrinurid trilobites remains from Funtanamare, Fluminimaggiore Fm., Ludlow. a) Damaged pygidium, dorsal view. b) Poorly preserved incomplete cranidium, dorsal view. c) Detail of the terminal piece of a pygidium.

material (only three pygidia and three very poorly preserved cranidia) makes assignment very delicate; however, the distribution pattern of tubercles on the glabella and the smooth surface and segmentation of the pygidium suggest a close relationship with the Encrinurid *Balizoma*.

Bivalves occur sporadically in the Fluminimaggiore Fm. Specimens of *Cardiola docens* Barrande and *Slava sathon* Kriz from Funtanamare were illustrated by Kriz & Serpagli (1993) in their monograph on Silurian bivalvia from Sardinia.

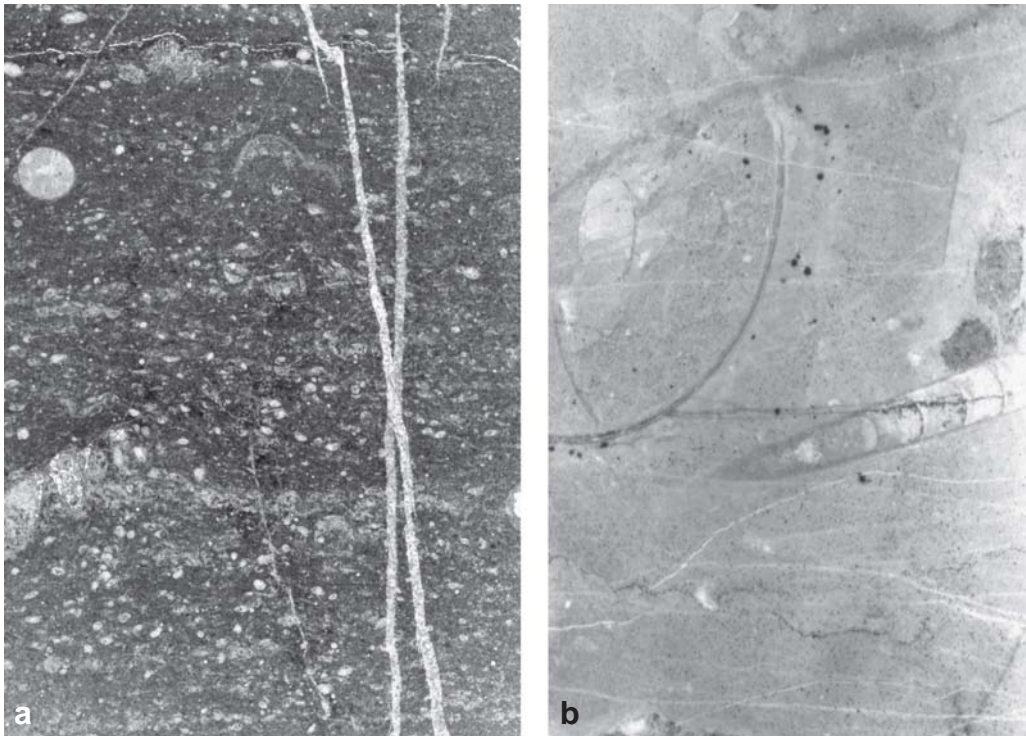


Fig. 5 - a) Levels of fine bioclasts mostly represented by thin ostracodes, sample FTM-BKS 2008 (Fluminimaggiore Fm.), *ploeckensis-siluricus* interval, x7. b) Sparse cephalopods in a fine micritic mudstone, sample FTM 3 (Mason Porcus Fm.), Lower Devonian, x5.

The macrofauna includes also nautiloid cephalopods, and, possibly, ostracods and phyllocarids. Trace fossils (?*Chondrites*) have been observed too.

In thin sections, fossils are distributed in dark mudstones (Fig. 5a) with small cephalopods associated to levels of ostracodes and thin shelled bivalves, rare trilobites and brachiopods. *Muellerisphaerida* are quite abundant in the matrix.

Lower Devonian limestones (Fig. 5b) show a light grey colour, with red patches and a stylo-nodular aspect. Fossil content is apparently scarcer, with dominant cephalopods and echinoderm debris.

Relatively abundant conodonts (Fig. 6) were collected from some blocks of the Fluminimaggiore Fm. All studied samples may be referred to a mid-Ludlow time. The conodont association includes: *Kockelella absidata absidata* Barrick & Klapper, *K. maenniki* Serpagli & Corradini, *K. variabilis variabilis* Walliser, *K. var. ichnusae* Serpagli & Corradini, *Ozarkodina confluens* (Branson & Mehl), *Wurmiella excavata* (Branson & Mehl) and *W. inflata* (Walliser).

A few conodonts were collected also from the nodular limestone of the Mason Porcus Fm., but the association is quite scarce and includes only a few poorly preserved specimens of *W. excavata* (Branson & Mehl), *Oulodus* sp. and *Zieglerodina* sp.

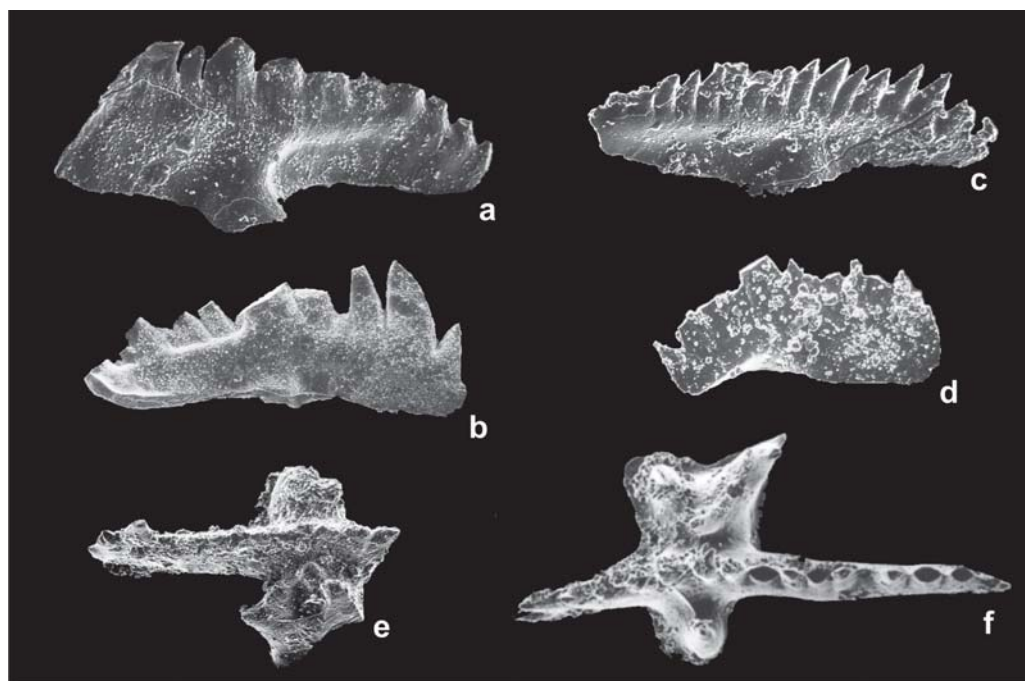


Fig. 6 - Silurian and Lower Devonian conodonts from Funtanamare. a) *Zieglerodina* sp., Pa element IPUM 28212, sample FTM A (Lochkovian), x50. b) *Zieglerodina* sp., Pb element IPUM 28213, sample FTM A (Lochkovian), x100. c) *Wurmiella inflata* (Walliser, 1964), Pa element IPUM 28214, sample FTM 2A (*ploeckensis* Zone), x100. d) *Kockelella absidata absidata* Barrick & Klapper, 1976, Pa element IPUM 28215, sample FTM 1 (*ploeckensis* Zone), x100. e) *Kockelella variabilis variabilis* Walliser, 1957, Pa element IPUM 28216, sample FTM 2A (*ploeckensis* Zone), x50. f) *Kockelella variabilis ichnusae* Serpagli & Corradini, 1998, Pa element IPUM 27490, sample FTM 2 (*siluricus* Zone), x66.

BIOSTRATIGRAPHY

All conodont samples from the Fluminimaggiore Fm. can be referred to the *ploeckensis* and to the *siluricus* zones (Ludfordian).

No precise biostratigraphical placing can be stressed from the scarce conodonts collected from the Lower Devonian Mason Porcus Fm.

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