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The Lower Graptolitic Shales at Rio Minderri and Rio Brabaisu-Rio Ollastu confluence (Rio Ollastu area, Sarrabus, SE Sardinia)

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LOCALITY Rio Minderri: a cliff (39°23'26.7"N, 9°27'07.5"E) and several rocks (39°23'25.7"N, 9°27'10.4"E) on steep, forested slope left of Rio Minderri. Rio Brabaisu-Rio Ollastu confluence (39°23'15.00"N, 9°26'55.24"E).

LITHOSTRATIGRAPHIC UNIT Lower Graptolitic Shales (informal unit).

AGE Rio Brabaisu-Rio Ollastu confluence: Aeronian through to early Telychian (Llandovery); Rio Minderri: Telychian (late Llandovery).

WHAT TO SEE siliceous black shales and lydites with flattened graptolite rhabdosomes and lenticular beds of pale-colored radiolarites.

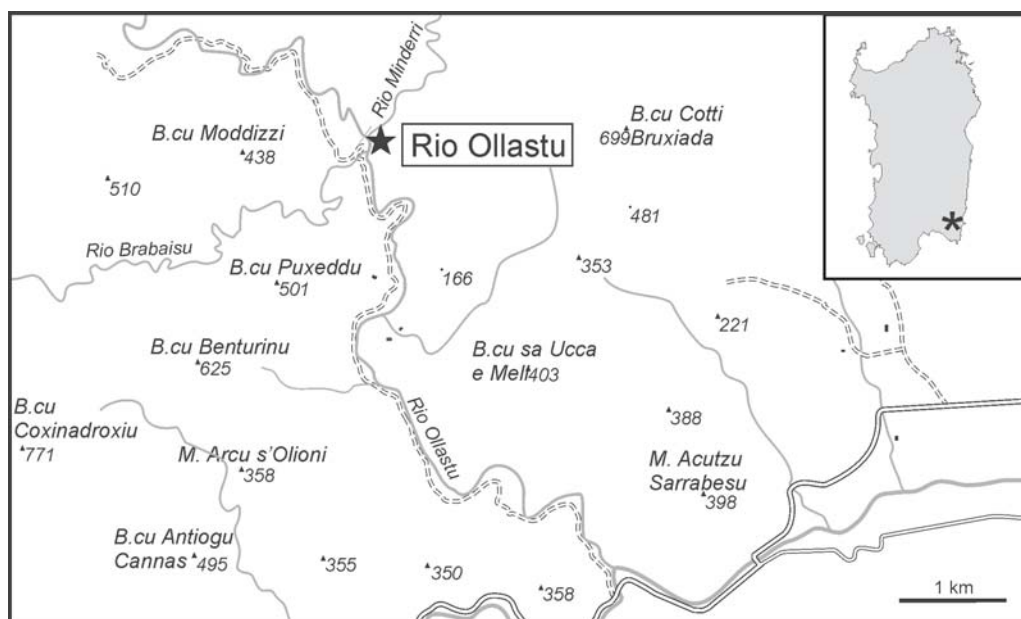


Fig. 1 - Location map of the graptolite outcrops in the Rio Ollastu area.



Fig. 2 - Flat-lying, overturned black lydites with subordinate siliceous shale intercalations exposed at the Rio Brabaisu-Rio Ollastu confluence: Lower Graptolitic Shales, Aeronian-lower Telychian.

HOW TO GET THERE

The locality is reachable from the old road SS 125 with about 6 km drive on a dirt country road in the Rio Ollastu valley. After parking near Rio Brabaisu and Rio Ollastu confluence, several distinct outcrops of black shales and lydites are reachable with short walks. The first outcrop is well visible on the right side, behind the river confluence; the second outcrop is about 600 m from the first one, above and below the cliff rock, on a steep slope left of Rio Minderri creek.

HISTORICAL OUTLINE

The two localities belong in a broader Silurian outcrop area discussed by Barca & Jaeger (1990). The two authors described an overturned section, formerly studied by Helmcke (1973), right above the Rio Brabaisu-Rio Ollastu confluence. This section was moreover studied for microfossils by Pittau et al. (2003). Rio Minderri Section was discovered by one of us (S.P.) in 2008 and referred to by Storch & Piras (2009).

LITHOLOGY

In the Sarrabus Unit the lower part of the Lower Graptolitic Shales consists of black, thick-bedded lydites with thin intercalations of siliceous shale. Small whitish lenticular beds of presumable radiolarites were reported by Barca & Jaeger (1990). About 10 metres thick succession of flat-lying lydites crops out at Rio Brabaisu-Rio Ollastu confluence.

Also Telychian succession at Rio Minderri rests overturned. It is formed of black platey lydites intercalated with siliceous shale.

FOSSIL CONTENT

Graptolite rhabdosomes are common in many beds but hard to collect due to either conchoidal splitting of lydites or cleavage planes oblique to the bedding of siliceous shale. At Rio Minderri, the fauna recovered from the lowermost part of the cliff consists of: *Retiolites ?angustidens* Elles & Wood, *Pristiograptus* ex gr. *dubius* (Suess), *Monoclimacis* cf. *linnarssoni* (Tullberg), *Monograptus priodon* (Bronn), *Oktavites spiralis* (Geinitz), *Oktavites falx* (Suess), *Lapworthograptus* cf. *grayae* (Lapworth), *Diversograptus ramosus* Manck, and *Diversograptus ?pergracilis* (Boucek). Small outcrop situated some 50 m upslope yields graptolites of the upper part of *turriculatus-crispus* Biozone: *Monograptus* ex gr. *priodon* (aff. *marri* Perner), *Spirograptus turriculatus* (Barrande), *Torquigraptus proteus* (Barrande), *Cochlograptus veles* (Richter), abundant *Streptograptus exiguus* (Lapworth), *Streptograptus crispus* (Lapworth), and extremely slender *Diversograptus* sp. Uncommon whitish spicules of siliceous sponges are seen on some bedding planes.

List of graptolites from extremely hard lydites at Rio Brabaisu-Rio Ollastu confluence, published by Barca & Jaeger (1990) involved: a) *Metaclimacograptus hughesi* (Nicholson), *Normalograptus* cf. *rectangularis* (McCoy), *Rhaphidograptus toernquisti* (Elles & Wood), *Monograptus* ex gr. *revolutus* Kurck, *Demirastrites triangulatus* (Harkness), and

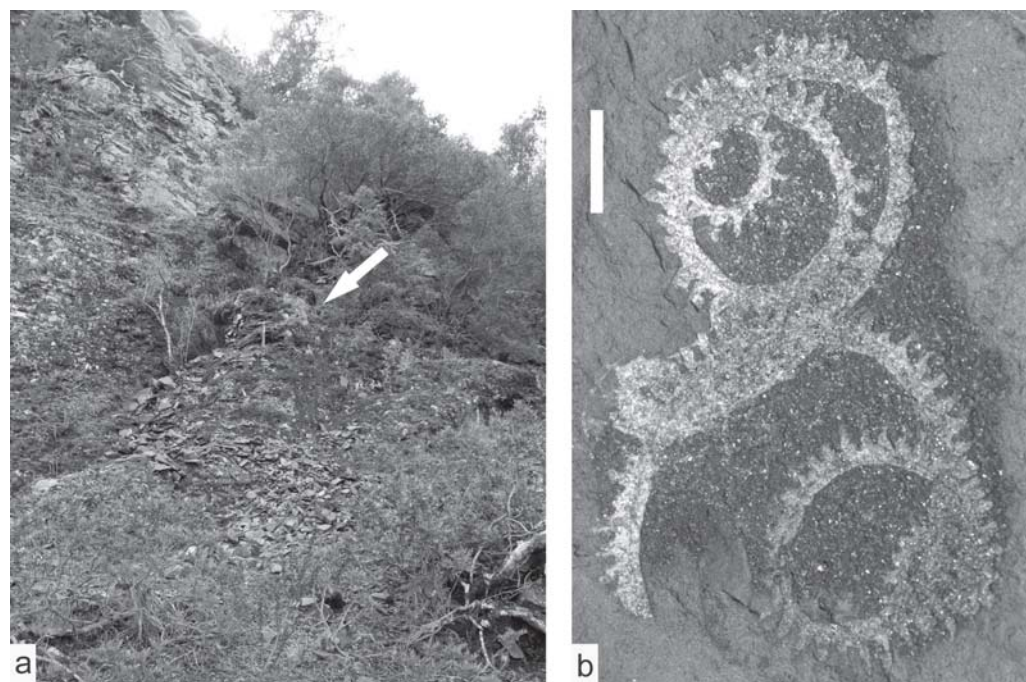


Fig. 3 - a) The cliff rock with the overturned succession of black lydites and siliceous alum shales at Rio Minderri: Lower Graptolitic Shales, Telychian. White arrow indicates the sampling site with graptolites of the *O. spiralis* Biozone. b) *Oktavites spiralis* (Geinitz).

Coronograptus gregarius (Lapworth) indicating the early Aeronian *D. triangulatus* Biozone; b) *Normalograptus scalaris* (Hisinger), *Rivagraptus bellulus* (Törnquist), *Pseudorthograptus insectiformis* (Nicholson), *Cephalograptus cometa* (Geinitz), *Pristiograptus* cf. *regularis* (Törnquist), ?*Monograptus limatulus* Törnquist, ?*Campograptus lobiferus* (McCoy), *Torquigraptus* ?*denticulatus* (Törnquist), and ?*Torquigraptus decipiens* (Törnquist) assigned to *Lituigraptus convolutus* Biozone, and c) ?*Spirograptus turriculatus*, *Monograptus marri* Perner, *Pristiograptus* ex gr. *nudus*, *Torquigraptus* cf. *planus* Barrande and ?*Parapetalolithus tenuis* (Barrande) from the supposed *S. turriculatus* Biozone.

Chitinozoans, radiolarians and sponge spicules have been reported from Rio Brabaisu-Rio Ollastu confluence by Pittau et al. (2003). Chitinozoans of the genus *Conochitina* - *Conochitina emmastensis* Nestor and *Conochitina* sp. Nestor - are recognized in the *L. convolutus* Biozone.

Radiolarians of the Order Spumellata are common in these two outcrops. An association of sponge spicules with specialized taxa *Nabaviella*? and *Thoracospongia ichnussiella* Pittau et al., assigned to *Desmospongia* and *Hexactinellidae*, are present from the *convolutus* Zone through to the *turriculatus-crispus* Zone (Pittau et al., 2003).

BIOSTRATIGRAPHY

At least three graptolite biozones have been reported by Barca & Jaeger (1990) from Rio Brabaisu-Rio Ollastu confluence – those of *D. triangulatus*, *L. convolutus*, and ?*Spirograptus turriculatus*.

Oktavites spiralis graptolite Biozone was indentified at the base of the cliff rock at Rio Minderri; the upper part of combined *Spirograptus turriculatus*-*Streptograptus crispus* Biozone crops out nearby.

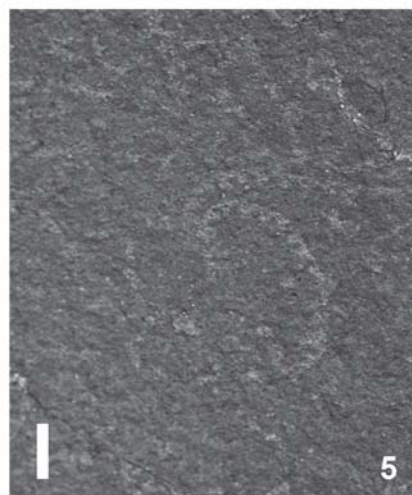
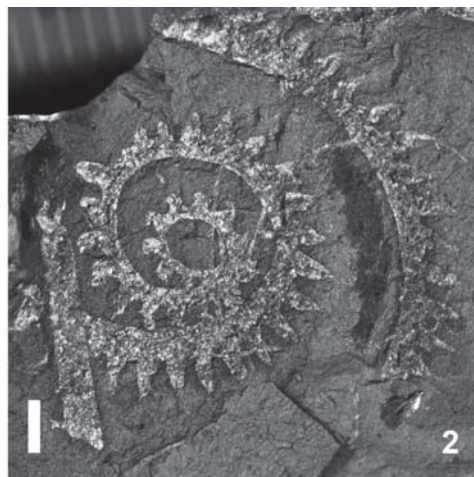
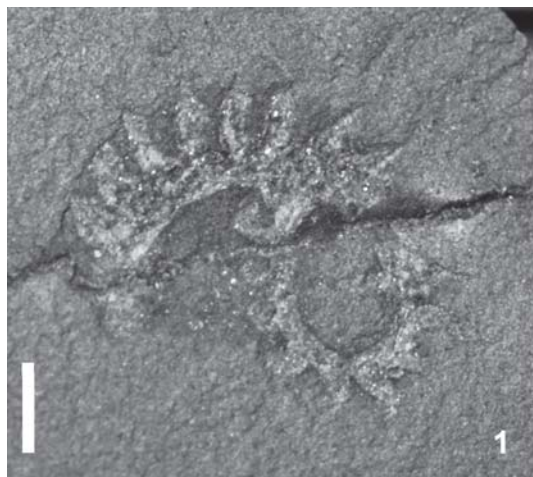
FURTHER NOTES

There are many natural outcrops and road-side exposures of the lower Silurian black lydites, siliceous shales and alum shales in this remote region where almost all the lower Silurian graptolite biozones have been recorded. The outcrops at Rio-Minderri and Rio Brabaisu-Rio Ollastu confluence belong to the best accessible localities of the Rio Ollastu area.

Plate 1

- Figs. 1-2 - *Oktavites spiralis* (Geinitz, 1852).
- Fig. 3 - *Monograptus* ex gr. *prionodon* (Bronn, 1835).
- Fig. 4 - *Oktavites falx* (Suess, 1851).
- Fig. 5 - *Streptograptus crispus* (Lapworth, 1876).
- Fig. 6 - *Torquigraptus proteus* (Barrande, 1850).
- Fig. 7 - *Diversograptus* sp. (Manck, 1923).

Scale bar = 2 mm.



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