

Short note – Nota breve

“*Lithiotis*” beds of the Rotzo Formation (Calcari Grigi Group, Lower Jurassic) from Albaredo (Rovereto, Trento)

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RIASSUNTO - *Livelli a “Lithiotis” della Formazione di Rotzo (Gruppo dei Calcari Grigi, Giurassico inferiore) di Albaredo (Rovereto, Trento)* - Vengono descritti alcuni spettacolari esempi della Facies a “*Lithiotis*”, collocati nella parte superiore della Formazione di Rotzo (Gruppo dei Calcari Grigi, Giurassico inferiore) e messi in luce da recenti lavori stradali. Il buono stato di conservazione degli esemplari, il colore scuro e la scarsa ricristallizzazione della matrice, e la notevole estensione laterale degli accumuli consentono di determinare con sicurezza i taxa, di riconoscere l’orientamento delle conchiglie e la geometria e modalità di crescita dei banchi. In particolare, è presente un accumulo biogenico tabulare costituito, nella parte inferiore, da conchiglie di *Lithioperna* in posizione di vita. Su questi individui, che colonizzarono il fondale con conchiglie suborizzontali, si ancorarono individui dello stesso genere che crebbero con conchiglie inclinate ed embricate. Queste ultime rappresentarono il substrato duro per la cementazione delle larve di *Cochlearites*, i cui gusci formarono la parte superiore del banco. Questo affioramento, contrariamente a quanto ritenuto dalla maggior parte degli autori, mostra che i banchi della Facies a “*Lithiotis*” non sono sempre monospecifici.

Key words: “*Lithiotis*”, Rotzo Formation, Calcari Grigi Group, *Lithioperna*, *Cochlearites*

Parole chiave: “*Lithiotis*”, Formazione di Rotzo, Gruppo dei Calcari Grigi, *Lithioperna*, *Cochlearites*

1. INTRODUCTION

During the Early Jurassic, large and aberrant bivalves of the “*Lithiotis*” fauna had a remarkable adaptive radiation, comparable with that of Cretaceous rudists, which allowed them to make up metre-thick shell beds (banks and mounds), widespread in the northern margin of Gondwanaland and along the western American continental margin (e.g., Bosellini 1972; Broglio Loriga & Neri 1976; Nauss & Smith 1988; Masetti, 2002; Fraser *et al.* 2004).

The Trento Platform (Southern Alps) represents a classical area for the study of these bivalves. They were recognized here for the first time and have been extensively studied since the 19th century. The “*Lithiotis*” beds are typical of the Rotzo Formation (former Rotzo Member) (Calcari Grigi Group). Many authors have worked on the stratigraphic, sedimentologic and paleontologic aspects of the “*Lithiotis*” beds. An exhaustive review and reference list has recently been published by Loriga Broglio (2000).

A new and spectacular road cut section of some “*Lithiotis*” beds is available near the Albaredo village (Vallarsa, Trento) (Fig. 1). In this exposure is possible a sure classification of the different bivalve genera occurring in the banks. Moreover, the banks are exposed laterally for several tens of meters. For these reasons, we are able to describe here the shell posture related to the different genera, geometry and lateral change of banks, and relationships with other coeval – but with different biofacies – beds.

2. REGIONAL GEOLOGICAL SETTING

The Calcari Grigi Group consists of a shallow marine carbonate succession which represents the Lower Jurassic in the Trento Platform (Southern Alps), a paleogeographic unit delimited eastward by the Belluno trough and westward by the Lombardy basin (Winterer & Bosellini 1981). This group is divided into four main units: the Monte Zugna

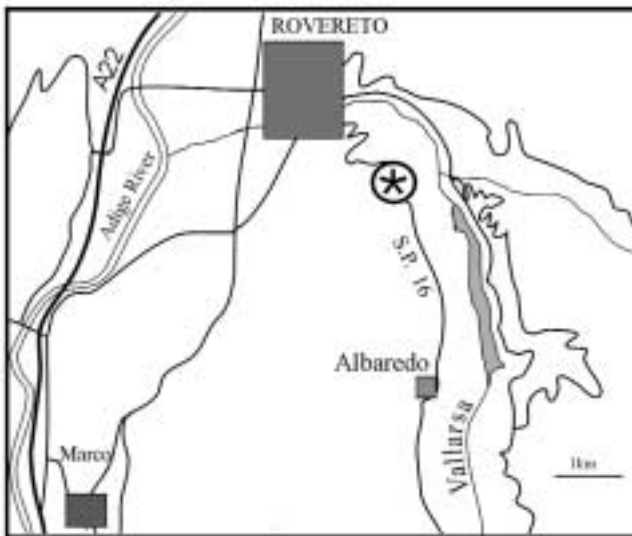


Fig. 1 - Geographical location of the described outcrop (asterisk).

Fig. 1 - Posizione geografica dell'affioramento descritto (asterisco).

Formation, the Loppio Oolite Formation, the Rotzo Formation and the Massone Formation (e.g. Bosellini & Broglio Loriga 1971; Masetti *et al.* 1998; Avanzini *et al.* 2004). The richest fossiliferous unit of the Group is the Rotzo Formation, late Sinemurian to Pliensbachian in age (Fugagnoli & Loriga Broglio 1998; Fugagnoli 2004).

3. FOSSILS OF THE ROTZO FORMATION

The Rotzo Formation contains rich shallow marine benthic faunas (foraminifers, brachiopods, bivalves, gastropods, echinoderms), which have been known since the 18th century (e.g., Dal Pozzo 1764; Böhm 1884; Tausch 1890). In particular, it is world-famous for its gregarious, large and aberrant bivalves of the "Lithiotis" Facies (e.g. Gümbel 1871; Tausch 1890; Böhm 1891; Reis 1903; Bosellini 1972; Accorsi Benini & Broglio Loriga 1977; Chinzei 1982). Besides, it contains a renowned terrestrial macroflora dominated by Bennettitales and subordinately by Coniferales, Filicales and Equisetales (for references see Loriga Broglio 2000).

3.1. The large aberrant bivalves of the "Lithiotis" facies

The "Lithiotis" facies refers to those Lower Jurassic sedimentary bodies (banks or mound) containing large and aberrant bivalves, mostly represented in the Trento Platform by the monospecific genera *Lithiotis*, *Cochlearites* and *Lithioperna* (e.g., Accorsi

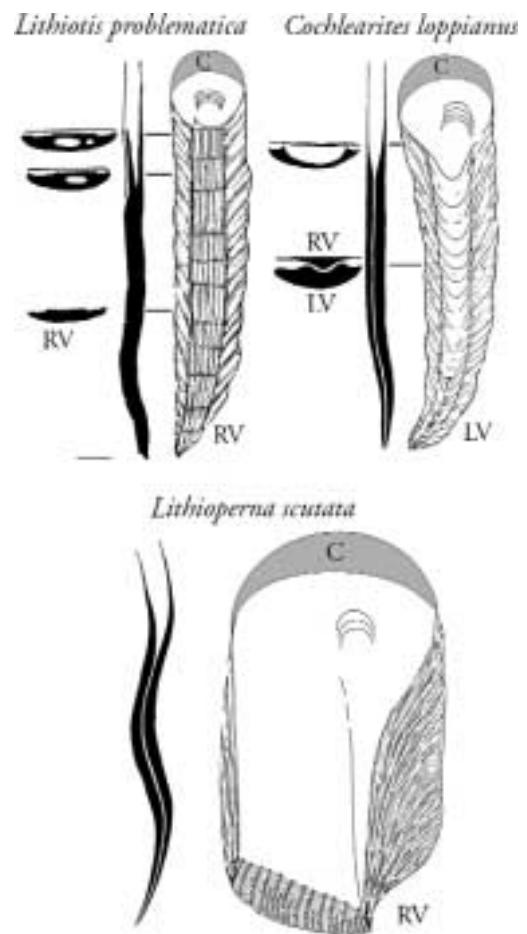


Fig. 2 - Some bivalves characteristic of the "Lithiotis" Facies. CF= Conchiolina fringe; LV= left valve; RV= right valve (from Debeljak & Buser 1998, mod.).

Fig. 2 - Alcuni bivalvi tipici della Facies a "Lithiotis". CF= Conchiolina; LV= valva sinistra; RV= valva destra (da Debeljak & Buser 1998, mod.).

Benini & Broglio Loriga 1977; Accorsi Benini 1979) (Fig. 2).

Lithiotis problematica Gümbel and *Cochlearites loppianus* (Tausch) are both characterized by an extremely elongated, narrow aragonitic shell with a small spoon-like body space placed in a high, ventral position, only rarely preserved. This aberrant morphology has been interpreted as an adaptation to soft, muddy bottoms with a high sedimentation rate (mud-sticker of Chinzei 1982 and Seilacher 1984). The young shells were cemented to hard substrates, often represented by adult valves or by shelly debris. Adult shells were almost completely infaunal and supported by mud and other shells. Differences between the two taxa, not always detectable in the outcrops, mostly concern shell inequivalvity and morphology of the middle plate. *L. problematica* is characterized by a markedly inequivalved, extremely elongated (30-40

cm high) shell, with a free valve, perhaps left, laminar and elastic, not thicker than 1-2 mm. The attached valve, 1-2 cm thick, is commonly preserved by fossilization. This valve shows a median furrowed plate, interpreted as a ligament area (Savazzi 1996), laterally bounded by two plume-like areas recording the growth phases of the mollusc.

On the contrary, *Cochlearites loppianus* (Tausch) shows a subequivalved shell, up to 60-70 cm high, with the left attached valve always thicker than the right one. Also in this genus, the lateral plume-like areas are present, but here they delimit a median region markedly different from "*Lithiotis*". The left valve shows a median concave area becoming convex in the right one; this area is characterized by some ligament grooves in the umbonal region.

Lithioperma is an Isognomonid bivalve with a byssate juvenile stage, whilst during the adult stage it developed modes of life depending on the individual density and bottom firmness (Broglia Loriga & Posenato 1996). The ecomorphic variability spans uninterruptedly from individuals with concave-convex cup-shaped shells, lying with horizontal commissural plane, to thin, flat and elongated semi-infaunal shells, with vertical commissural plane.

Geometries, origin and palaeoecology of the "*Lithiotis*" bodies, which show their maximum development in the upper Rotzo Formation, have been widely discussed by Bosellini (1972), and more recently by Masetti *et al.* (1998), Posenato *et al.* (2000) and Masetti (2002). These shell accumulations range from tabular bodies (banks), 2-4 m thick, to lens-shaped bodies (mounds), generally 2-3 m thick (maximum 10 m high). According to Masetti *et al.* (1998), the Rotzo Formation is formed by asymmetrical thickening and shallowing-up cycles, with marl-limestone alternations at the base and calcarenites or "*Lithiotis*" beds at the top.

"*Lithiotis*" bodies grew at the transition between open and restricted lagoon; they are sometimes capped by other gregarious, but not large, bivalves such as the byssate *Pseudopachymytilus mirabilis* (Lepsius) and *Gervilleioperma ombonii* (Negri), forming lenticular bodies (Clari 1975), no more than 1 m thick, which settled in a shallow subtidal or intertidal environment (Broglia Loriga & Neri 1976).

3.2. Palaeoenvironment

The Rotzo Formation was formed in an articulated lagoon environment with low islands fringed by marsh, and separated from the open sea by an oolitic barrier island complex (Bosellini & Broglia Loriga 1971). Therefore, the formation yields a wide spectrum of litho- and biofacies, which range from supratidal and marsh to subtidal and open lagoon environments.

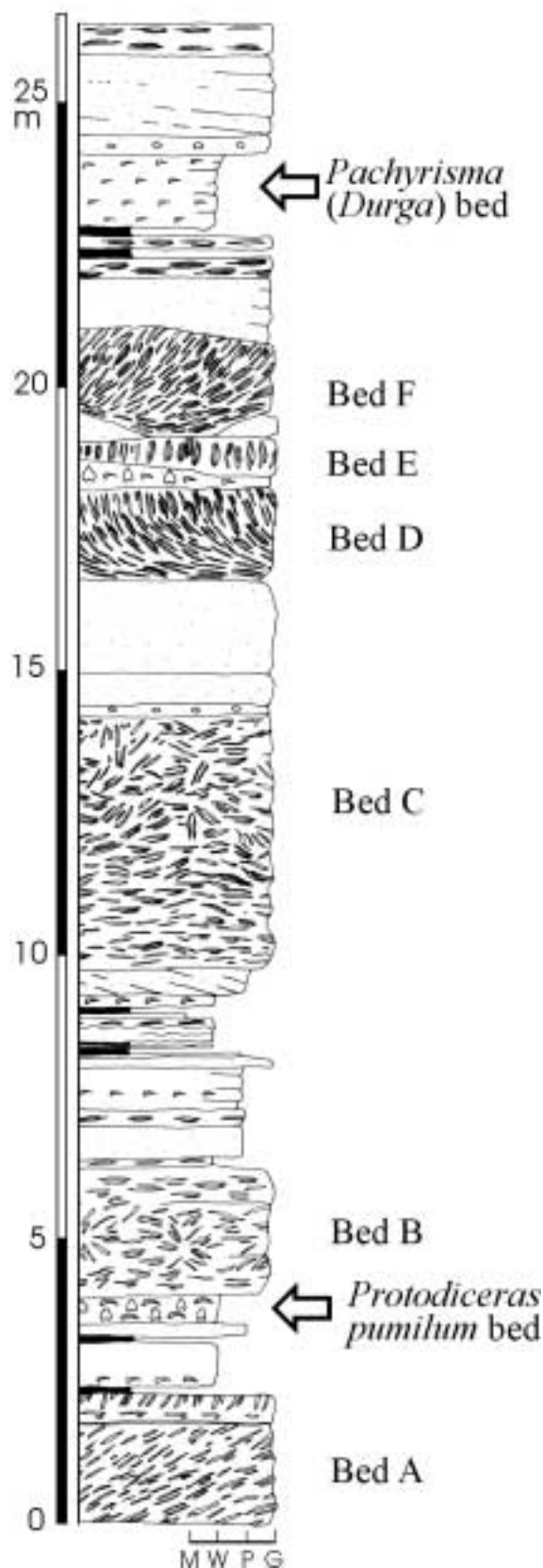


Fig. 3 - Lithological column of Albaredo, upper Rotzo Formation, Calcarei Grigi, Lower Jurassic.

Fig. 3 - Colonna litologica di Albaredo, parte alta della Formazione di Rotzo, Gruppo dei Calcarei Grigi, Giurassico inferiore.

4. THE “LITHIOTIS” BEDS OF ALBAREDO (ROVERETO)

The outcrop is located on the left side of Vallarsa, along the road connecting Rovereto (TN) with Albaredo (Fig. 1). It contains some “Lithiotis” beds, several tens of metres in length, and has a thickness of about 25 m thick (Fig. 3). This stratigraphic segment records of the upper part of Rotzo Formation, which

in this area is about 130 m thick. The segment contains six “Lithiotis” beds. For some of these, good exposure conditions and wide lateral continuity make it possible to determine the genera and body geometry.

The following description concerns those “Lithiotis” beds outcropping near the road bend, where a recent section affords good exposure conditions (Figs 4, 5).

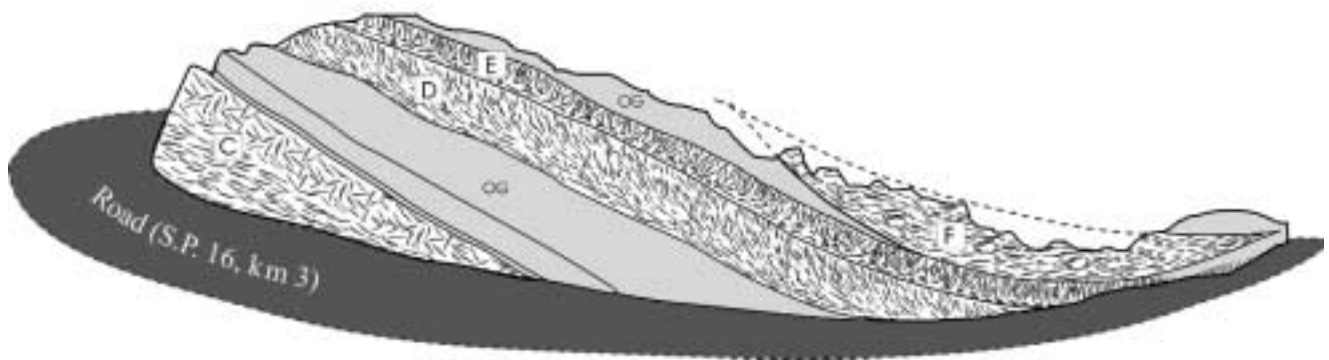


Fig. 4 - Sketch of the Albaredo road cut outcrop with some “Lithiotis” beds (C, D, E, F). OG= oolitic grainstone.

Fig. 4 - Schizzo interpretativo dell'affioramento lungo la strada Rovereto-Albaredo con evidenziati i banchi a “Lithiotis” descritti nel testo (C, D, E, F). OG= grainstone oolitici.

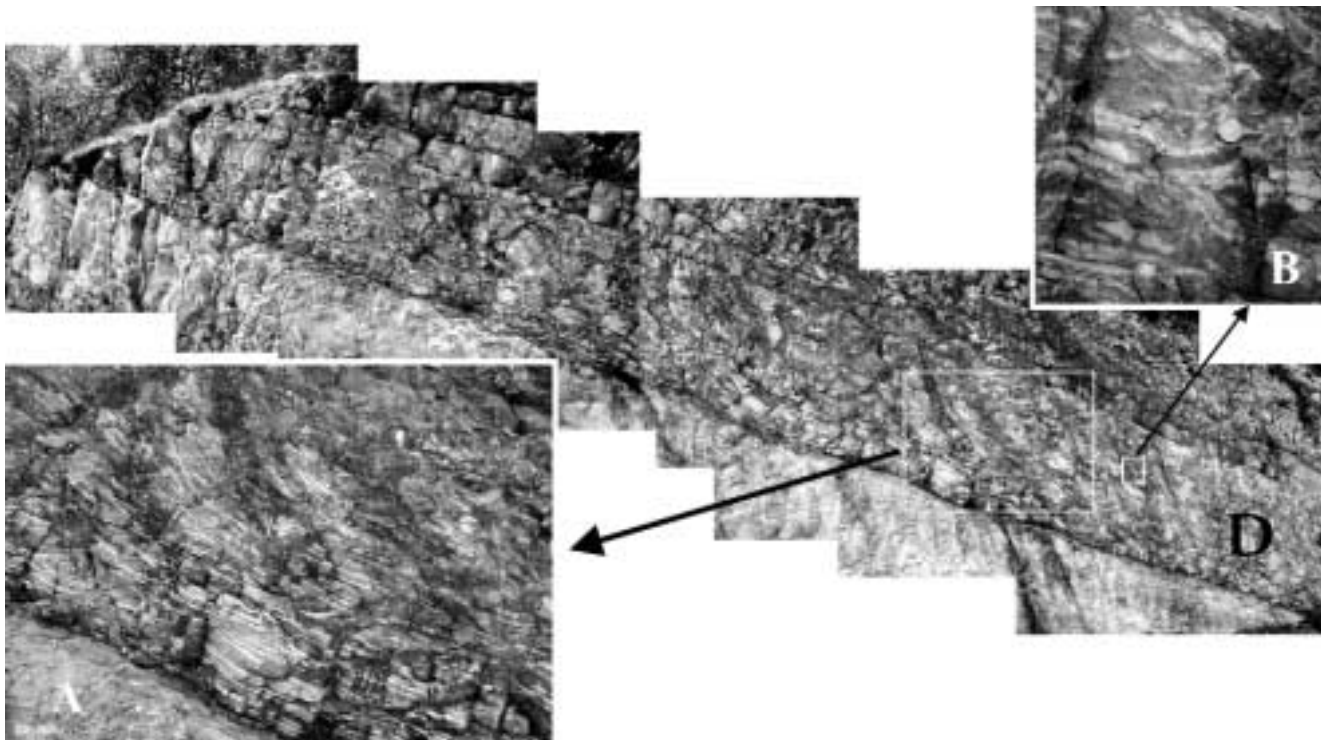


Fig. 5 - The bank D, about 1.5 m thick, formed in the lower part by flattened and equivalve shells of *Lithioperna scutata* (detail A), and *Cochlearites loppianus* in the middle-upper part with the characteristic transversal sections and inequivalve shell (detail B).

Fig. 5 - Il banco D, spesso circa 1,5 m, formato nella parte inferiore da conchiglie piatte ed equivalvi di *Lithioperna scutata* (particolare A), e *Cochlearites loppianus* della parte medio-superiore con le caratteristiche sezioni trasversali e conchiglia inequivalve (particolare B).

- **Bed C** is the first shell accumulation and the thickest (4.5 m) of the described segment. Undeterminable large shells have positions ranging from horizontal, in the lower part, to chaotic, in the upper part.
- **Bed D** is tabular, at the scale of the outcrop, and about 1.5 m thick. It is made up of densely packed shells, which in the lower part are mainly represented by strongly elongated, equivalved and flat individuals of *Lithioperna*, whose whitish recrystallized valves stand out from the dark grey matrix. This early phase, with horizontal shells, is followed by slightly inclined, curved and imbricated *Lithioperna* individuals; the latter provided the hard substrate for cementation of the *Cochlearites* larvae. Shells of this genus make up the middle-upper part of the bank.
- **Bed E** contains *Cochlearites*, whose characteristic transverse sections can be observed where the bed reaches the road plane. The prevalently upright position of the shells suggests their life position. This body rests on an oolitic grainstone (15 to 40 cm in thickness) with frequent, large and disarticulated valves and shells of megalodontids, which probably represented the hard substrate onto which the larvae and juvenile individuals of *Cochlearites* were cemented. This bed may exemplify the first stage of colonization and formation of a mound (Posenato *et al.* 2000; Masetti 2002), whose growth ceased soon after.
- **Bed F**, probably formed by *Cochlearites*, is a lens-shaped body which thins out until it disappears to the right (downward on the road), where it is laterally replaced by oolitic grainstones. Other bivalves of the Rotzo Formation can be observed in the lower and upper parts of the outcrop. In the lower part of the stratigraphical succession (further up the road), there is a *Protodicerias pumilum* (Gümbel) coquina, about 50 cm thick, which is followed by a *Cochlearites* body (bed B) (Fig. 3). In the upper part of the succession (further down the road), other megalodontids [*Pachyrisma (Durga) cf. crassa* (Böhm), *Protodicerias pumilum* (Gümbel)] and mytiloids [*Pseudopachymytilus lepsii* (Tausch)] can be observed on the blocks of road wall. The shells, although deformed, preserve their original aragonitic composition. They were extracted from the nearby outcrop (at the top of the column Fig. 3).

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