Microfacies and Cyclic Sedimentation of the Upper Triassic (Rhaetian)
Calcare di Zu (Southern Alps)

Mikrofazies und zyklische Sedimentation
des obertriadischen (rhätischen) Calcari di Zu (Südalpen)

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SUMMARY

The Rhaetian facies of the Lombardian Basin (Southern Alps) are syn-rift deposits characterized by a high rate of deposition, considerable variation of thickness and a cyclic deposition of limestone-shale/marl alternations in which the limestone beds mostly show a thickening-upward trend. Each thickening-upward asymmetric cycle represents a relatively minor shallowing which in most cases is reflected by changes in the microfacies types. The superposition of these minor cycles resulted in an overall shallowing of the sedimentation and thus two major thickening-upward cycles were distinguished. This paper shows the interrelationship between facies patterns and the evolution of a shallow basin, describes the cyclicity of the sedimentation and discusses possible causes. A comprehensive microfacies analysis of the Calcari di Zu is presented. Fourteen microfacies that vary from shallow basin facies to intertidal/supratidal facies are identified. Almost all the major biotic constituents described from the Rhaetian deposits of the Tethys are present, but their diversity is rather low. The fauna and flora of the Calcari di Zu include corals, sponges, calcareous algae, microproblematica, 'tabulozoa', 'hydrozoa', bivalves, brachiopods, echinoderms, gastropods, serpulids and very rare ammonites. All the Upper Triassic foraminifers seem to be present. Compared to the foraminifers in the Northern Calcareous Alps some marked differences in their distribution patterns can be observed. Triasina hantkeni MAJZON is present in the algal foraminiferal facies, algal laminated bindstone facies, oncoidal facies, bioclastic grainstones and in the biolithite facies. Agathammina austroalpina KRISTAN-TOLLMANN & TOLLMANN is not restricted to the terrigenous mud facies, but is found in the peloidal bioclastic packstone/grainstone facies and in the lumachelle facies. In places oolitic grainstones are rich in foraminifers. Some of the oolitic grainstones yield ooids whose nuclei are almost entirely composed of foraminifers. Miliolids (Galeanella sp., Ophthalmidium sp.) characteristic of the biolithite facies are very rare, Signinoila sp. is lacking. The distribution pattern of foraminifers is not strictly facies controlled.

1 INTRODUCTION

The purpose of this study is a detailed microfacies analysis of the Calcari di Zu and an interpretation of the depositional environments and of the evolution of the Lombardian Basin during the Rhaetian. The analysis of the distribution and as-
sociation of the biota is focused on the frame-building and potential frame-building organisms. Moreover, the cyclicity of the deposition is described and possible causes are discussed. Previous work on the Rhaetian deposits of the Lombardian Basin is rare and mostly stratigraphical or paleontological (STOPPAM, 1857; ALLASINAZ, 1962; GNACCOLI, 1965). Recent papers are by FAWRISI SESTÀ & MOTTA (1983; taxonomic study of the corals of Calcare di Zu), MASZERI et al. (1989; discussion and interpretation of the cyclic deposition), STEFANI & GOLFERI (1989; stratigraphy of the Rhaetian facies in the Giudicarian/Lake Garda area from where the transition of the Lombardian Basin and the Trento Platform is described).

2 GEOLOGICAL AND STRATIGRAPHICAL SETTING

During the upper Triassic (Norian) shallow-water and peritidal conditions prevailed in most of the west Tethyan region. In the Southern Alps the Norian is predominantly represented by the Dolomia Principale. Its stratigraphic equivalents in the Northern Calcareous Alps are the Hauptdolomit and the Dachstein Kalk (TOMA, 1976). Local intraplatform basins coeval with the Dolomia Principale have been identified in the Lombardian Basin and are ascribed to a Norian rifting (Dolomia Zonate, Calcare di Zorzino; JABOT, 1986; ccca et al., 1987). The main phase of rifting preceeding the Piedmont-Ligurian ocean however, occurred in the latest Triassic 'Rhaetian' period to the Early and Middle Liassic (BERNOULLI & LEMOINE, 1980; LEMOINE & TROMPY, 1987). Such rifting movements are documented particularly in the Lower Jurassic of the Southern Alps by synsedimentary block-faulting that disintegrated the former carbonate platforms. The evolution of this future passive continental margin differs from the classical evolution of passive margins in that there was no volcanic activity associated with the rifting phase and the actual oceanic opening took place to the west of the area where the initial rifting and thinning of the crust occurred. During the Rhaetian the Arbostora High and the Trento Platform remained high, while the adjacent blocks subsided. In the west, in the Monte Nudo Trough only a few tens of meters of shallow water and intertidal carbonates accumulated (Kalin & Trompy, 1977). Similarly, on the Trento Platform in the east, the shallow water peritidal carbonate deposition continued while the Lombardian Basin was subjected to differential subsidence. About 2000 m of shales, marls, limestone and dolomites were deposited (Argiillii di Riva di Solito, Calcare di Zu, Dolomia a Conchodun).

The boundary between the Norian and the Rhaetian in the Lombardian Basin has been traditionally fixed at the top of the Dolomia Principale or its heteropic facies. Boundaries and subdivisions of the Rhaetian have been discussed using ammonites and conodonts (WIEDMANN, 1972; KOZUR, 1973; KRYSTYN, 1974, 1987; TOZER, 1979; WIEDMANN et al., 1979; GAZDZICKI et al., 1979; GOLEBOWSKI, 1986). Other biostratigraphic zonations of the Rhaetian are based on foraminifers (Gazdzicki, 1974) in which the Rhaetian is divided into two zones: Glomospirella? pokorny and Glomospirella frieldi zones corresponding to the Lower Rhaetian and Triasina hantkeni zone corresponding to the Upper Rhaetian. Austrotrinchnia cornigera (Schaufuss) a brachiopod can be used as an index fossil for the Rhaetian (PEARSON, 1977).

3 DESCRIPTION OF THE MEASURED SECTIONS

Six sections of the Calcare di Zu were measured and described in detail (Figs. 1-8). A coral-bearing limestone unit was sampled in detail in order to study the frame-building and potential frame-building organisms.

Denti della Vecchia Section (Fig. 2)

The section is located on the Italian side of the Swiss/Italian border, south of the 'Denti della Vecchia' near the 'Alpe di Castello'. It is approximately 190 m thick and consists mainly of thin-bedded (10-30 cm) limestones and dolostones deposited at the margin of the Lombardian Basin. They differ from the typical Calcare di Zu which is mainly composed of shallow basinal facies. Vertical facies sequences correspond to oolitic grainstone cycles (probably shoaling-upward cycles, Wilson, 1975). The section starts on top of the Dolomia Principale represented by algal laminated fenestral dolostones overlain by transitional fine-grained saccharoidal dolostones interbedded with argillaceous badly outcropping layers. The oolitic grainstone cycles are 8-20 m thick starting with argillaceous mudstones and wackestones which are commonly laminated and partially dolomitized. They are followed by peloidal bioclastic packstones; the cycles are capped by cross-bedded well-sorted bioclastic oolitic grainstones with worn and coated bioclasts and distinct ooids. In some cycles oncoidal bioclastic packstones occur at the top.

The coral-bearing limestones (Fig. 2, arrow) are bedded and form small discontinuous patches. Their maximal thick-