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THE EARLY/MIDDLE TRIASSIC BOUNDARY ON CHIOS ISLAND:PRELIMINARY RESULTS OF A REINVESTIGATION

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ABSTRACT

On Chios island, the sections at the Scythian/Anisian boundary (BENDER 1967, ASSERETO et al. 1980) were reinvestigated in detail, and further ammonoids and microfossil samples were collected within the Hallstatt type limestones. Two ammonoid assemblages could be discerned, a lower one belonging to the Prohungarites-Subcolumbites zone (Spathian) and an upper one of early Anisian (Aegean) age. The Scythian/Anisian boundary is defined with the first appearance of the latter. Regarding significant conodont species, we state that Gondolella regale MOSHER appears a little higher than the first Anisian ammonoids, whereas G. timorensis NOGAMI was found already below these ammonoids, in one section even together with a pure Spathian ammonoid fauna. Foraminifera are very rare and cannot be used as additional stratigraphic criteria.

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The Upper Scythian-Lower Anisian succession of Chios fits well to what is known from other places in the Tethys realm, but it is difficult, furtheron, to connect them strictly with North American sequences. Although the Chios sections seem to be influenced by stratigraphical condensation to a certain degree, they provide the best reference for the Scythian/Anisian boundary within the western Tethys.

INTRODUCTION

The island of Chios receives much attention by Triassic stratigraphers since RENZ & RENZ (1948) had published a rich Lower Triassic ammonoid fauna from Marathovouno hill. Later on, H. BENDER (1967) found Anisian ammonoids and conodonts immediately above the Scythian faunas, and JACOBSHAGEN & TIETZE (1974) pointed to a similar sequence at Parthenis hill, nearby. Based upon new collections of ammonoids, ASSERETO (1974) proposed the Aegean to be the new basal substage of the Anisian. Further efforts to define the Scythian/Anisian boundary exactly were published by ASSERETO et al. (1980), after the previous death of the first author. NICORA (1977) reported on conodonts from the Anisian levels, FANTINI SESTINI (1981) on the Anisian ammonoids. Recently, the Chios sections and their significance for the Scythian/Anisian boundary were discussed by WANG YI-GANG (1985) and BUCHER (1989).

Due to different reasons, it was not possible to continue field work for many years. Thanks to the great interest and support of Dr. B. Andronopoulos, General Director of IGME, and of Prof. I. Mariolakos of the University of Athens, a further field campaign could be carried out by M. Gaetani, V. Jacobshagen, A. Nicora and V. Tselepidis in 1989. Among the collected fossils, the Scythian ammonoids were determined by D. Mertmann, the Anisian ones by N. Fantini Sestini. G. Kauffmann and A. Nicora investigated the Scythian and the Anisian conodonts, respectively. V. Skourtsis-Coroneou contributed the determinations of foraminifera and of carbonate microfacies of our samples. The palaeontological investigations and the geological evaluation of the sections are not yet complete. Here we may present some preliminary results.

GEOLOGICAL SETTING

As reported by BESENECKER et al.(1968, 1971), Chios island is composed of two tectonic stockworks (fig. 1 a). The lower one shows clear affinities to the Pelagonian units of mainland Greece. It was overthrust by a nappe exhibiting a quite different stratigraphic sequence which cannot be connected with the well known Hellenide zones. Between both units, tectonic melanges or even extended scales are exhibited in limited areas.

Our research concerns the Triassic of the lower unit in the central part of the island (fig. 1 b), which had been investigated and mapped in detail by TIETZE (1969). Here the Triassic sequence covers a Palaeozoic basement disconformably (table 1). It starts with medium-bedded limestones of Upper Scythian age (Basal Series), followed by the Lower Carbonate Unit with thick- or unbedded shallow-water limestones and dolomites with varying thicknesses. In the research area, the latter does not surmount some tens of meters, but may grow up to more than 400 m in other localities of the island. In our sections, that series is overlain by an extended lense of red nodular limestones of the Hallstatt facies which were called Marmarotrapeza limestones by RENZ & RENZ (1948).

Both the Lower Carbonate Series and the Marmarotrapeza Fm. respectively, are covered by the Variegated Series (Bunte Serie, BESENECKER et al. 1968) of Anisian to Lower Ladinian age, which seals an irregular platform morphology. It comprises conglomerates, sandy marls, bedded dolomites, cherty limestones, several Hallstatt type limestone lenses, radiolarites and keratophyric tuffs and tuffites.

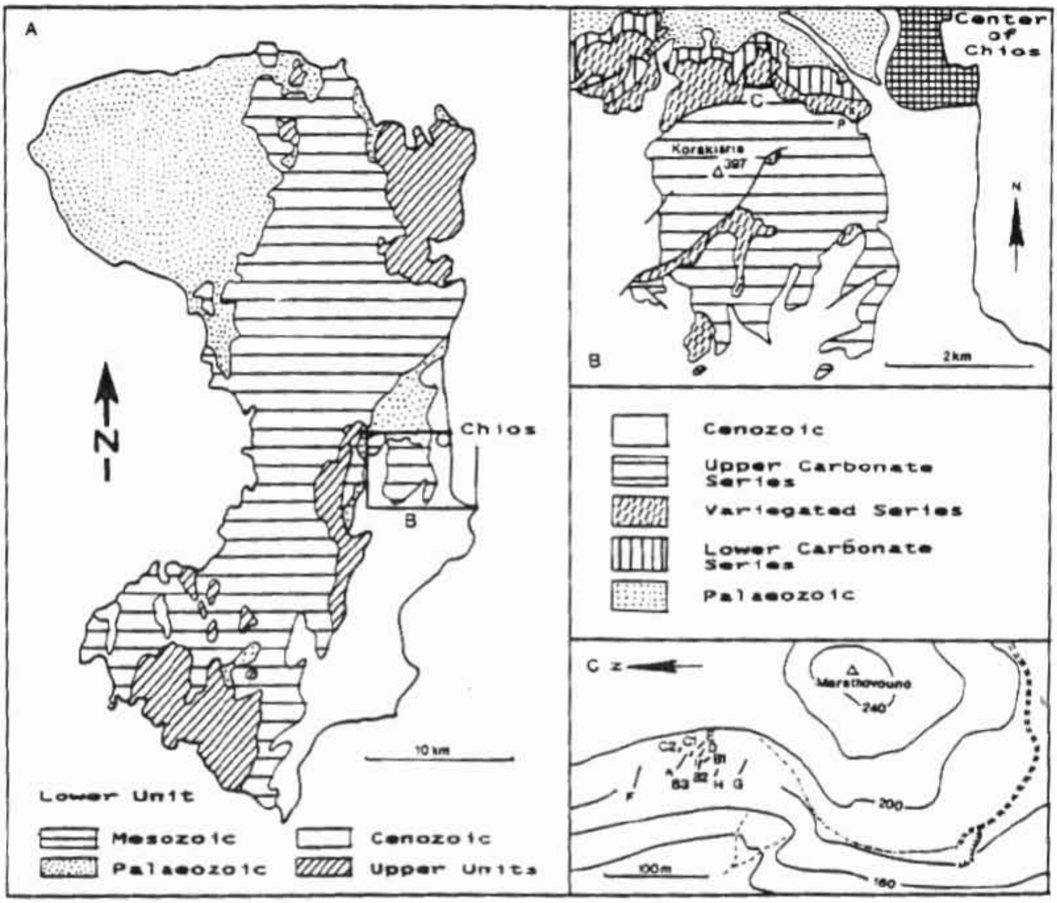

Fig. 1: The research area on Chios island.- (A and B after BESENECKER et al. 1968 and 1971, C after ASSERETO et al. 1980).
P = Parthenis section.

The Upper Carbonate Series consists of algal limestones and dolomites ranging from the Ladinian to the Middle Jurassic. In our area near Mt. Korakiaris (fig. 1 b), it is represented by cherty limestones with Ladinian and Carnian fossils.

Dogger Lias Upper Triassic	Upper Carbonate Series
Ladinian	
Anisian	Variegated Series
	Marmarotrapeza Fm.
Upper Scythian	Lower Carbonate Unit
	Basal Series
Palaeozoic rocks	

Tab. 1: Triassic-Jurassic stratigraphy of the lower tectonic unit of Central Chios (after BESENECKER et al. 1968 and TIETZE 1969).

BIOSTRATIGRAPHIC RESULTS

During the second campaign, we revisited the sections of ASSERETO et al. (1980) at Marathovouno hill (fig. 1 c). It was, moreover, possible to investigate a small, but very fossiliferous section in the Parthenis area, about 500 m west of Chios town. In all sections, the massive dolomites of the Lower Carbonate Series are conformably covered by the Marmarotrapeza limestones, which are followed by volcaniclastic rocks of the Variegated Series.

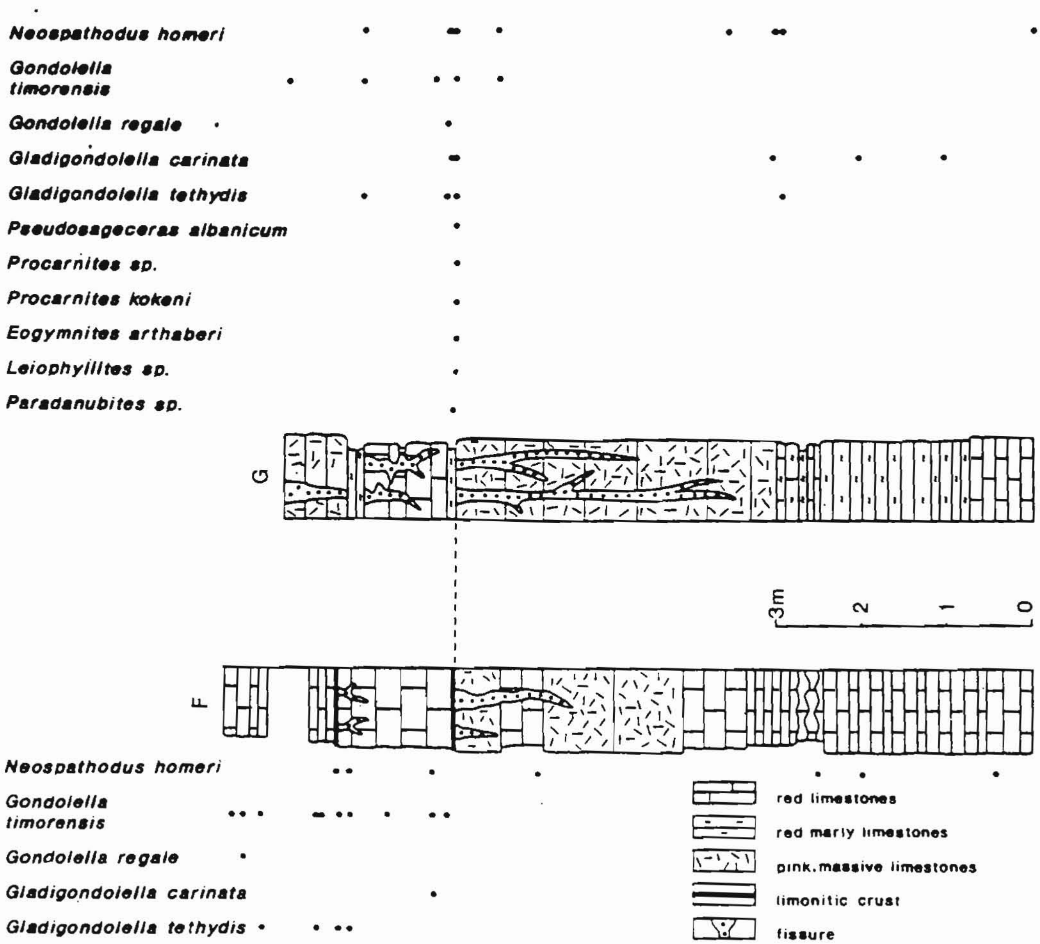

Fig. 2: Two of the revisited sections across the Hallstatt lense of Marathovouno hill, redrawn after ASSERETO et al. (1980)

In this paper, discussion is confined to the sections F and G (fig. 2) of ASSERETO et al. (1980). G is nearly identic with section CM I of BENDER (1967). Both exhibit thicknesses of about 9 m. They start with thin- to medium-bedded red nodular limestones, somewhat marly in section F, which may be characterized as filamentous biomicrites to biomicrosparites with fragments of bivalves, ammonoids, and echinoids. A few samples yielded undeterminable ostracods and silicified Nodosariidae. The middle parts of both sections consist of thick-bedded pink limestones, entirely recrystallised and partly dolomitized, whereas in the upper parts the same facies as in the lower parts predominate again. Here we observed, moreover, several thin dark reddish layers connected with fissure fillings, some of them going down for more than 3 m. Thus, carbonate solution and stratigraphic condensation have to be envisaged at least there. Both sections can be subdivided with the help of conodonts, while ammonoids were only found within the upper part of section G.

Ammonoids: Within section G, the horizon CH 258 of ASSERETO et al. (1980) could be subdivided into three thin layers(fig. 3). The lower one yielded typical Spathian ammonoids, such as Procarnites kokeni ARTHABER, Pseudosageceras albanicum ARTHABER and Eophyllites arthaberi DIENER, which belong to the Prohungarites-Subcolumbites zone of KUMMEL (1973). But from the same level came the two Cladiscitids mentioned by ASSERETO et al. (1980, p. 725), which have to be regarded as Anisian elements. Directly above, a single specimen of Paradanubites sp. was found in the middle layer. It belongs to the Aegeiceras-Japonites assemblage (FANTINI SESTINI 1981) of the basal Aegean. Thus, in section G the Scythian/Anisian boundary is influenced by condensation, to a certain degree. In the nearby section A+C+D (i. e. CM II of BENDER 1967) the two ammonoid faunas are, however, strictly separated, as was already demonstrated by ASSERETO (1974), ASSERETO et al. (1980) and FANTINI SESTINI (1981).

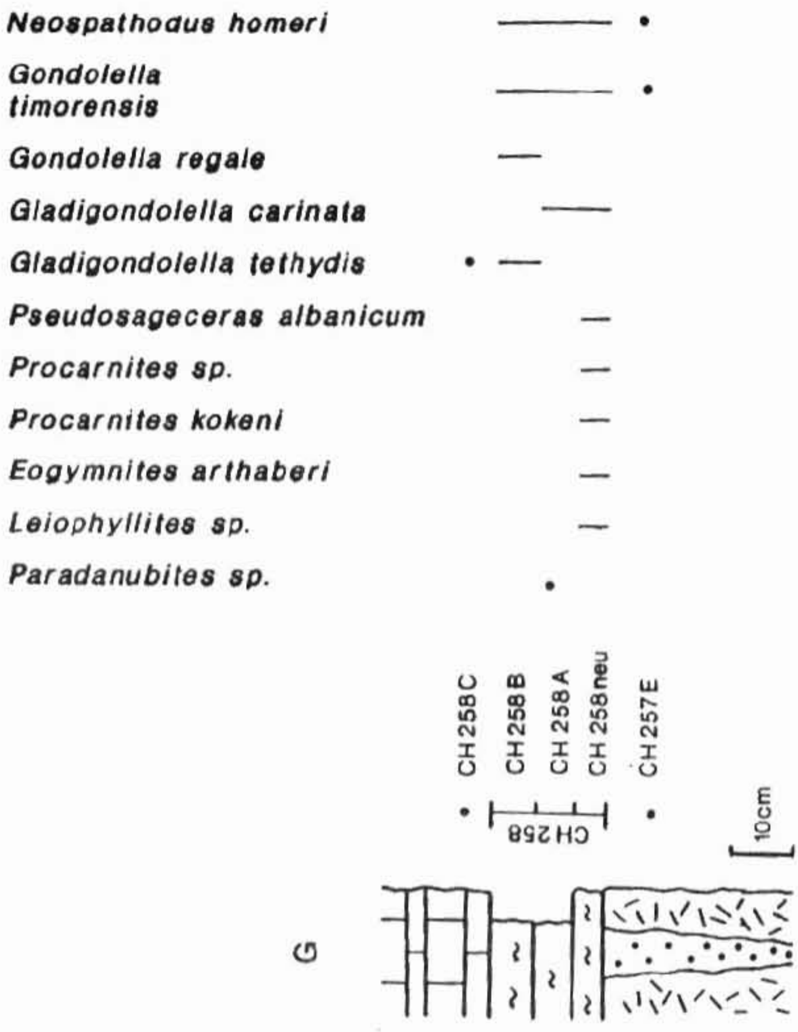

Fig. 3: Subdivision of the horizon CH 258 into three thin layers and distribution of ammonoids and conodonts within. Legend see Fig. 2.

Conodonts: Among the conodonts, we confine the discussion to the most important species only. According to our present knowledge, Neospathodus homeri (BENDER) is confined to the Upper Scythian everywhere in the world. Gondollela regale MOSHER is a typical Anisian element, without any doubt, and Gondolella timorensis (NOGAMI) was proposed to mark the base of the Anisian by NICORA (1977) and ASSERETO et al. (1980).

In section G, N. homeri overlaps for about 60 cm with G. timorensis. Two single specimens of N. homeri found together with the Paradanubites and, even somewhat higher up, together with Gondollela tethydis and G. timorensis are considered to have been reworked. Homeri/timorensis overlaps had already been recognized by ASSERETO et al. (1980) and were then generally interpreted by stratigraphical condensation. In section F, the overlap between G. timorensis and N. homeri concerns, however, nearly 1.1 m and cannot be explained there by fissure fillings. Referring to the ammonoids of section G. we state that the first appearance of G. timorensis is a little below the first Anisian ammonoids, together with Scythian ones. The latter result seems remarkable, although stratigraphical condensation cannot be excluded here. The first appearance of G. regale is in the upper layer of CH 258, i. e., a few centimeters above the Paradanubites bed.

Foraminifera: Foraminifera and other microfossils are rare in our sections. The samples of the sections in discussion yielded nothing except a few silicified Nodosariidae in G.

To summarize we may state:

1. Within the red Marmarotrapeza limestones, only two ammonoid faunas can be distinguished, the Upper Scythian Prohungarites-Subcolumbites assemblage and the Lower Anisian (Aegean) Japonites-Aegeiceras assemblage. Although both seem to be mixed by condensation in section G, these faunas are distinctly separated in a neighbouring section. Further evidence for this fact will be provided by the authors in the near future.

2. Among the conodonts, Gondolella regale on one hand appears within the sections a little later than the first Anisian ammonoids, i. e.,already within the Aegean interval. G. timorensis on the other, overlaps clearly with N. homeri and has its first appearance within a condensed bed with prevailing Upper Scythian and a few Lower Anisian ammonoids.

With respect to these facts, we propose to define the Scythian/ Anisian boundary on Chios island with the first appearance of the Japonites-Aegeiceras ammonoid fauna or, if ammonoids are missing, above the homeri/timorensis conodont assemblage.

DISCUSSION

Looking for long-range correlations with the Chios sections, several questions arise:

1. Are the Chios sections fairly continuous at the Scythian/ Anisian boundary or is there a gap within the faunal sequence?

2. How can we manage a parallelisation between the Chios faunas and the ammonoid zonation of the arctic regions, well established by TOZER (1965, 1967, 1978), SILBERLING & TOZER (1968), DAGYS & DAGYS (1982), WEITSCHAT & DAGYS (1989) and others.

Both questions are connected with the problems of the arctic Subrobustus zone: Is it Late Scythian or Early Anisian in age and is it developed everywhere in the world? All authors cited above agree in its Late Scythian age, referring to the character of the ammonoid fauna (see also WANG YI-GANG 1985). ASSERETO et al. (1980) had, however, proposed to consider the appearance of G. timorensis to indicate the beginning of the Early Anisian.

This position would imply that the Neopopanoceras haugi zone would be totally included into the Anisian according to the distribution of G. timorensis (COLLINSON & HASENMUELLER 1978). But according to our new results, it seems also possible to assume that this conodont species had its first appearance already in the Upper Spathian. Thus, the conodont argument of ASSERETO et al. (1980) would not be urgent.

There is, however, some doubt about the ubiquity of the Keyserlingites subrobustus ammonoid association, since WANG YI-GANG (1985) had demonstrated that the species of Keyserlingites found in the Tethys realm are accompanied by typical Anisian forms as Paradanubites, Japonites, Aegeiceras, and Procladiscites everywhere, from Central Qinghai/China over Timor to the Middle and Western Himalayas. WANG concluded from these assemblages that the Tethyan Keyserlingites forms are probably younger than K. subrobustus. Consequently, he regarded the arctic subrobustus fauna to be the upper part of the Prohungarites-Subcolumbites zone of KUMMEL (1973), being restricted to the arctic realm by palaeogeographic reasons. Furthermore, he parallelized the Aegeiceras ugra fauna with the Lenotropites-Japonites fauna of Qinghai. Following WANG's arguments, the Chios ammonoid sequence must not necessarily imply an important gap.

Regarding the new results of BUCHER (1989), we are inclined to correlate the Aegeiceras-Japonites beds of Chios with the lowermost Anisian Japonites welteri beds of Nevada on the following reasons: NICORA (1977, fig. 3) plotted the conodont distribution in the Star Peak Canyon section of Nevada against lithology and ammonoid content studied by SILBERLING & WALLACE (1967, 1969). There the Eophyllites sp. A of SILBERLING & WALLACE (1969) has been renamed Japonites welteri by BUCHER, who considers the Star Peak Canyon section as the type-locality of the J. welteri beds. From NICORA (1977) it can be deduced that G. regale appears above the J. welteri beds, exactly as it does on Chios in relation to the Aegeiceras-Japonites beds.

Thus, we must not assume a considerable gap at the Scythian/Anisian boundary, within the Chios sections, although a certain amount of stratigraphical condensation is evident at least in some of them. Anyhow, these sections offer the best reference for the Scythian/Anisian boundary in the Western Tethys, according to our present knowledge.

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