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THE CONTACT ZONE BETWEEN PHYLLITE - QUARTZITE AND GAVROVO - TRIPOLIS UNIT IN THE TAYGETOS MOUNTAINS, MESSENIA

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ABSTRACT

The incoherent thrust sheet of the Phyllite-Quartzite (PhQu) Unit is divided into three sub-units with different composition and metamorphic overprinting. The basal series is a very low grade metamorphic sequence of shales, black (? euxinic) shales and sandstones. It is tectonically overlain by quartzites and mica schists which locally contain metaconglomerates. This middle part of the PhQu Unit is characterized by a greenschist metamorphism. The uppermost PhQu Unit consists of hp/lt metamorphic rocks.

Between the PhQu Unit s.str. and the Tripolis Unit a new, formerly unknown series, the Miaouli Unit is located, which consists of fossil-free massive white marbles, shales and quartzites. This formation shows greenschist metamorphism and is supposed to be of Permotriassic age.

The Tyros formation is separated tectonically from the platform carbonates of the Tripolis Unit, though it is considered to be the original basement.

The carbonates of the Tripolis Unit can be subdivided into several lithostratigraphic units: massive and stromatolitic dolomites (upper Triassic) and the Aetos limestone (Liassic to oldest Cretaceous).

1. INTRODUCTION

The Mani peninsula and the Taygetos mountains are built up by the "Plattenkalk", the Phyllite-Quartzite (PhQu) and the Gavrovo-Tripolis Units. Locally small klippes of Olonos-Pindos series occur. Our new detailed mapping and investigations concentrated on the contact area between the lower PhQu Unit and the higher Gavrovo-Tripolis Unit in the vicinity of Artemisia NE of Kalamata, Messenia. We intended to set up a better lithological subdivision of the different tectonic Units and to find new fossil proved ages of the rocks. From bottom to top the following tectonic units were found.

2. PHYLLITE - QUARTZITE UNIT (s.l.)

As already confirmed by BLUMÖR & KOWALCZYK (1993) and others the Phyllite-Quartzite nappe consists in southern Peloponnesus mostly of 3 subunits, different in metamorphism and lithologic succession. Until now, no fossils have been found in the PhQu Unit of the Peloponnesus. Former fossil findings are from the Tyros Formation, wich was assumed to be part oft the PhQu Unit.

2.1 Phyllites-Quartzite Unit I (very low grade metamorphic)

The basal part of the PhQu Unit consists of thick brown shales, quartzitic sandstones and black shales which are dipping westwards. A cleavage with

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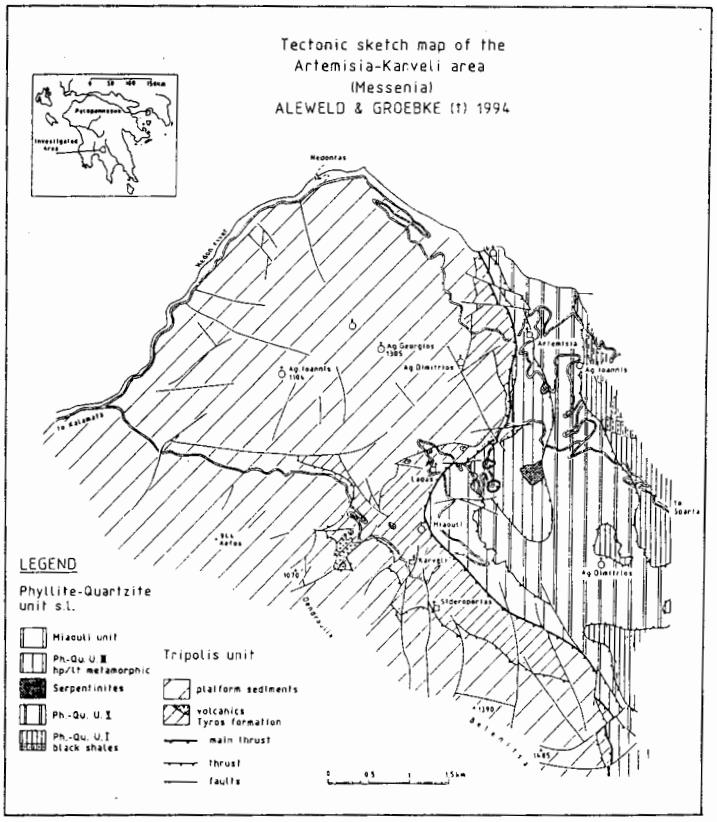

Fig. 1: Tectonic sketch map of the Artemisia - Karveli area (Messenia)

an inclination of 60° to the sedimentary bedding plane is developed. The base of this sequence is not exposed in the investigated area. The PhQu Unit I appears locally in small windows below the tectonically higher PhQu Unit II (fig. 1). For the black shales a deposition under anoxic or even euxinic conditions can be assumed.

Indications for an inverted position of the PhQu Unit I were not found, fold structures are absent. The total thickness of the succession is approximately 200 m.

2.2 Phyllite-Quartzite Unit II (greenschist grade metamorphic)

This unit covers the largest area in the vicinity of Artemisia. It consists predominantly of mica rich phyllites with intercalations of quartzite.

In the basal parts of the series metaconglomerates with flattened pebbles are intercalated, locally they occur in erosional grooves of the underlying metapelites. The pebbles of the conglomerate are entirely of a crystalline origin, no carbonates were found. The maximal lenght of the pebbles reaches 20-30 cm.

In mica rich parts of the PhQu Unit II dark andalusite is common, grown parallel to the cleavage plane. Under the microscope chiastolite is frequently found, posttectonically grown under stress-free conditions. Wether the chiastolite is indicating a second ? contact-metamorphic event, is still under investigation.

The thickness of the middle metamorphic part of the PhQu Unit II is

about 350 metres.

2.3 Phyllite-Quartzite Unit III (hp/lt metamorphic)

Also this part of the PhQu Unit consists entirely of metasediments, originally sandstones and shales. Garnets up to 5 mm are macroscopially visible in schists which are rich in white mica. Under the microscope glaucophane and chloritoid is found. Partially the garnet is changed to chlorite and biotite.

The total thickness of the hp/lt metamorphic part of the PhQu Unit II is about 200 metres.

Between the PhQu Units II and III several isolated tectonically inserted bodys of serpentinite were found. The X-ray investigation revealed that only the mineral antigorite (besides of some chlorite and opak minerals) is present.

2.4 Miaouli Unit (PhQu Unit s.l.)

On the geological map Kalamata 1:50.000 (IGME 1986) the lower part of this unit was incorporated into the Phyllite-Quarzite series while the upper part was included into the Tyros beds.

The lithological section of the newly separated Miaouli Unit (after the hamlet Miaouli between Karveli and Ladas) consists in its lower part of a sequence of dark quartzites and slates with intercalations of thin marble beds. The characteristic mineral association is chlorite, epidote and Ca-rich clinozoisite.

The upper part of the Miaouli Unit with predominantly massive white marbles developes after a 3 m thick transition. In the upper marbles bedding planes and thin intercalations of schists with mica, chlorite and clinozoisite are dominant.

The total thickness of the Miaouli sequence ist about 300 metres, with about 150 m of the upper series. Though no fossil were found in the sequence it is assumed, that the Miaouli Unit is originally the permotriassic cover of the PhQu Unit and therefor a time, but not a facies or metamorphic equivalent of the Tyros -Formation.

A similar sequence within the "Phyllite series" was discribed by BRAUER et al. (1980) in Lakonia and with forams determinated as Anisian.

3. GAVROVO - TRIPOLIS UNIT

A question, widely discussed in the literature is the composition and stratigraphic sequence of the Gavrovo-Tripolis Unit. Today it is commonly agreed, that the Tyros beds (KTENAS 1924, "couches de Tyros") are the lowest part of the series, though they are mostly tectonically separated from the overlying carbonate platform sediments.

3.1 Tyros formation

The Tyros sequence covers tectonically the Miaouli Unit. In the investigated area nonmetamorphic bedded dark limestones, dolomites, sand- und siltstones, green and violet shales are parts of the lithological column. In limestones near Artemisía THIEBAULT (1982) has found fossils of Permian age.

Volcanics, which are frequently found, consist of igneous rocks, tuffs and a sedimentary clay cover. Calculations with the CIPW standard show a composition between hawaiite and mugearite for the igneous rocks while the tuffs indicate a trachyandesitic composition (fig. 4). Samples from the Krokee area have a similar chemistry. Flattened glass lenses, which also include external rock fragments, prove an ignimbrite event near Karveli. Chlorite, mica and siderite in the metasedimentary cover of the igneous rocks indicate a beginning greenschist metamorphism. The Tyros formation is therefore not an uniform basement of the Gavrovo-Tripolis Unit but a mostly

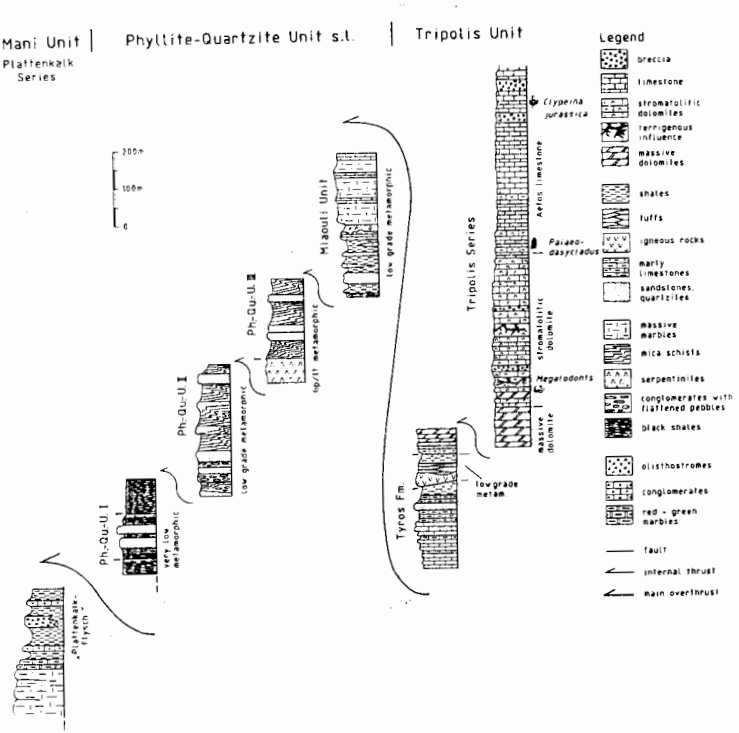

Fig. 2: Lithological columns of the different tectonic units

tectonically separated subunit.

3.2 Carbonate platform development of the Gavrovo-Tripolis Unit

The carbonate platform sediments of the Gavrovo-Tripolis Unit begin at the base with a massive dolomite of about 150 metres thickness and are followed by 350 metres thick banded stromatolitic dolomites. Megalodonts are frequently found (fig. 2).

After a transitional sequence the dolomits are followed by rose-coloured micritic limestones of about 100 metres thickness, the basal part of the newley created Aetos formation (after mount Aetos 944 m, west of Karveli). Within the overlying 400 - 500 metres of light and dark limestones Paleodasycladus mediterranus (PIA) and Siphovalvulina sp. were found. The exact position of the boundary Triassic/Lias can not be fixed more precisely, we assume the dolomite to be Triassic, the limestones to be Jurassic in age. The uppermost part of the Aetos formation is built up by 250 metres of shallow water limestones with stromatolites, fossil fragments and the calcareous alga Clypeina jurassica FAVRE (Tithonian to older Cretaceous).

Outside of the investigated area the platform development of the Tripolis zone continued until Eocene times. In Oligocene occured a distinct change in sedimentation to deep water basinal clastics ("Tripolis Flysch"). The Oligocene deep water sediments are tectonically overlain by klippes of the Pindos thrust sheet.

4. STRUCTURAL DEVELOPMENT

The PhQu Unit of the Peloponnesus cannot longer be considered as a homogeneous coherent crystalline thrust sheet within the stack of hellenic nappes. Different lithological sequences and different metamorphic overprinting demand a subdivision into three successions free of carbonates and

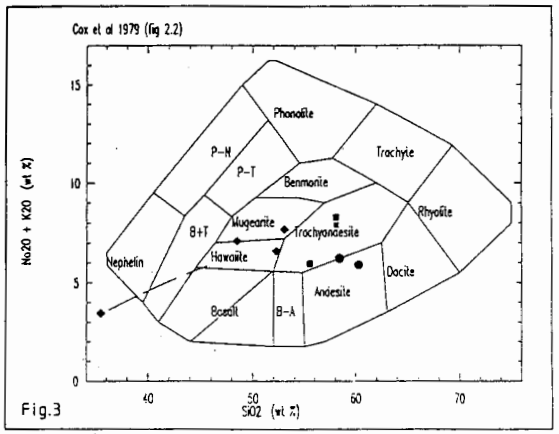

Fig. 3: CIPW calculations from volcanics and pyroclastics of the Artemisia - Karveli area and from Krokee.

the marble containing Miaouli Unit.

The lowest PhQu Unit I which is almost non metamorphic is not identic with the "Plattenkalk-Flysch" because there is no carbonate content and no fossils were found.

The hp/lt metamorphic blueschist subunit within the PhQu Unit, which covers the two lower carbonate free sequences has formerly given reason to suggest, that the whole stack is inverted, with the highest metamorphic rocks on top. We have not found any indications for a tectonic inversion, therefore we assume that tectonic thrusting and mixing has caused the pile of subunits. After the Oligocene the PhQu Units have overthrusted the lowest tectonic unit in the western Hellenids, the deep water flysch sediments of the Plattenkalk Unit and suffered extensional stretching and thinning.

The newly introduced Miaouli Unit is only found in a small area, where the

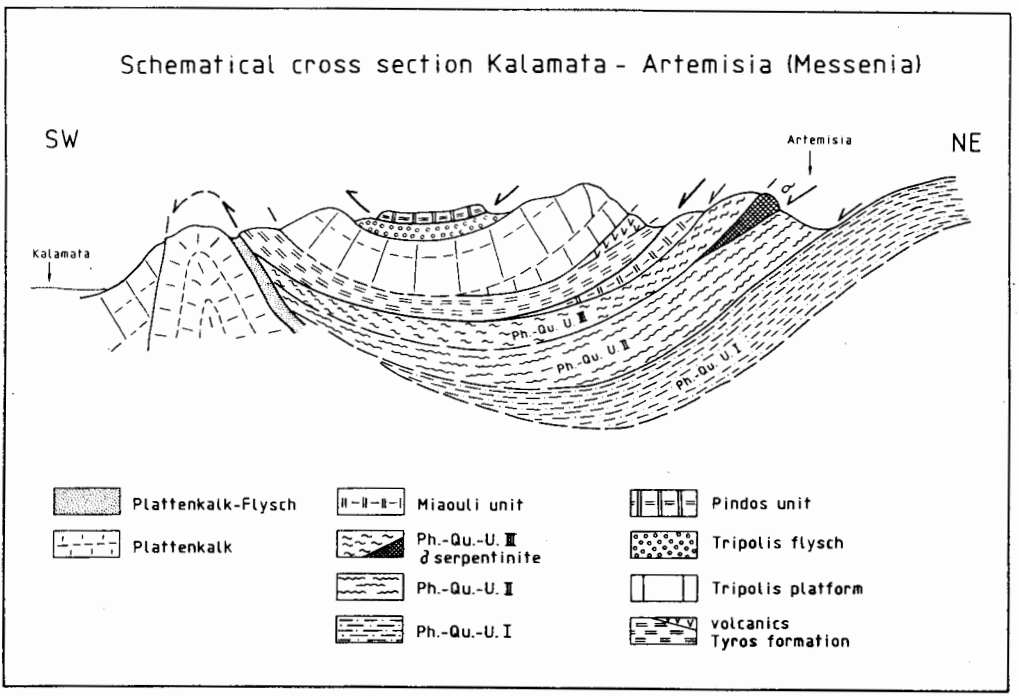

Fig. 4: Schematical cross section Kalamata - Artemisia, Messenia

thrust plane between PhQu Unit and Tyros Formation dips more steeply to the W than further to the N and S and therefore this unit was preserved.

The platform carbonates of the Tripolis Unit are always separated by a distinct thrust plane from the underlying Tyros formation. It is also very obious that the dolomites and limestones of the Tripolis Unit are less recrystallized than the Tyros beds. Also the tectonic deformation of the Tyros formation, where two folding axes, an older NS trending axis and a younger EW trending with N vergence is obvious, differs from the more fault dominated deformation in the platform carbonates (FYTROLAKIS 1987; ZELLIDIS & DOUTSOS 1992).

For the rootless fossil free PhQu Unit s.l. (PhQu Unit I - III, Miaouli Unit) it is difficult to find the original palinspastic position within the Hellenic facies belts. Since blueschist metamorphism occurs only in the surrounding of the Cycladic crystalline, PAPANIKOLAOU (1984) suggested an origin of the PhQu Unit from this eastern area. A more external origin of the PhQu nappes W of the Gavrovo-Tripolis platform is also discussed in the literature (e.g. by ROBERTSON & DIXON (1984), JACOBSHAGEN (1986), BLUMOR & KOWALCZYK (1993), KOVACS (1993)).

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