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Possible Middle Cretaceous Olistostrome in the Rechnitz Series (Eastern Austria)

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With 1 table

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Burgenland
Penninikum
Mittelkreide
Olisthostrom
Metamorphose

Zusammenfassung

Es besteht die Möglichkeit, daß die dünnschichtigen Grünschiefer der oberen Zone der Rechnitzer Serie aus von transgressiven ophiolithischen Decken stammendem vulkanomiktischem Material bestehen, daß die in den Grünschiefern eingelagerten Serpentinit- und Gabbrolinsen und -körper aus denselben Decken stammenden Olistolithe sind und daß die oberste, aus massiven Gesteinen bestehende Zone des Grünschieferschichtenpaketes sich schon als tektonische Decke abgelagert hat, wie die darüber befindlichen Sepentinit-Platten. Wenn man berücksichtigt, daß die darunter abgelagerten Sedimente dem Aptien oder einem jüngeren Zeitalter zugeordnet werden können, ist ein Vergleich mit den Karpaten möglich. Da das Zeitalter der Hochdruckmetamorphose im Tauernfenster um 110 Ma vermutet wird und das in den Westkarpaten sicher als Präbarreme angegeben wird, spielte sich die ähnliche Blauschiefermetamorphose der Metabasite aus der Rechnitzer Serie möglicherweise vordem ab, bevor sich die ophiolithischen Decken in der Nähe der Rechnitzer Gebietes gebildet haben. Die Grünschiefermetamorphose aus der ganzen Serie ist wesentlich jünger, aus dem Tertiär-Zeitalter.

Summary

The possibility is discussed that the thin-layered greenschists in the upper part of the Rechnitz Series consist of volcanomictic material derived from advancing ophiolithic nappes, that the lenses and blocks of serpentinites and gabbros within the greenschists are olistoliths from the same nappes, and that the topmost parts of the greenschists complex consisting of massive rocks, lie as tectonic nappes like the serpentinite sheets above them. The Aptian or younger age of the underlying sediments allows to make a comparison with the Carpathians. Since the age of the high pressure metamorphism is thought to be of about 110 Ma in the Tauern Window and is certainly pre-Barremian in the West Carpathians, the similar blueschist metamorphism of the metabasites of the Rechnitz Series, possibly, could take place prior to the appearance of ophiolithic nappes near the Rechnitz area. The greenschist metamorphism of the whole series is much younger, i. e. Tertiary in age.

Résumé

On peut définir la possibilité, que les schistes verts finement stratifiés de la partie supérieure de la série de Rechnitz sont composés du matériaux de volcanomicte origine des nappes ophiolithiques et corps de gabbro parus dans les schistes verts sont les olistolithes d'origine des mémes nappes, et, que la partie supérieure de schiste vert compe sée des roches massives s'est établie dans la forme de nappe tectonique, tout comme les plaques de serpentine de dessus. En concernant l'age aptien ou bien plus jeune des sédiments sous-jacents une comparison peut etre réalisée avec les Carpathes. Comme l'age du métamorphisme de haute pression est jugé á peu prés 110 Ma dans la fenetre Tauern, et c'est surement pré-barrémien dans les Carpathes Occidenales, on peut penser, que le métamorphisme de schiste bleu similaire des métabasites de la série de Rechnitz s'est déroulé avant de l'apparation des nappes ophiolitiques environ de la région de Rechnitz. Le métamorphisme de schiste vert de tout la série est bien plus jeune, d'un age tertiaire.

Резюме

Возможная среднемеловая олистострома в рехницкой серии /Восточная Австрия/

Можно предполагать, что тонкослоистые зеленые сланцы в верхней части рехницкой серии сложены вулканомиктовым материалом с продвигающихся офиолитовых покровов, что линзы и тела серпентинитов и габбро, залегающие среди зеленых сланцев, представляют собой олистолиты с тех же покровов и что наивысшие горизонты зеленых сланцев, состоящих из массивных пород, залегают в виде тектонических покровов, как и пластины серпентинитов над ними. Принимая во внимание аптский или более молодой возраст подстилающих отложений, можно провести сопоставления с Карпатами. Поскольку возраст метаморфизма высоких давлений считается около 110 млн. лет в окне Тауэрн и является заведомо добарремским в Западных Карпатах, сходный голубосланцевый метаморфизм метабазитов рехницкой серии, возможно, имел место до появления офиолитовых покровов вблизи от Рехницкого региона. Зеленосланцевый метаморфизм всей серии имеет значительно более молодой, третичный возраст.

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SCHMIDT's (1950) fundamental idea that the Rechnitz Series can be correlated with the Penninic Series was evidenced by PAHR's (1960, 1977) detailed field observations and by SCHÖNLAUB's (1973) finding Middle Cretaceous spongia spiculae. This correlation is now generally accepted.

The Rechnitz Series crops out in East Austria in tectonic windows from-below the Austroalpine nappe-system (Wechsel and Semmering: PAHR, 1980a) and the Miocene sedimentary sequences (Sinnersdorf Conglomerate etc.). The geological map by PAHR (1982) that covers most of the East Austrian Penninic area and his stratigraphic scheme (PAHR, 1980b; 1984) serve as reliable basis for any geological conclusions. Based on PAHR's data the **stratigraphy** of the Rechnitz Series can be outlined as follows:

1. The lower prevalent part consists of calcareous-argillaceous metasediments of at least 2 km thickness.
2. Upwards the metasediments pass into thin-layered ("tuffitic") greenschists.
3. The thin-layered greenschists are overlain by massive greenschists that may be developing from them through alternations.
4. On the top of the greenschist complex, serpentinite sheets rest as tectonic slices or nappes sometimes with gabbros at the base.

Within the greenschists, serpentinite and gabbro lenses and blocks and Triassic limestones can be observed.

The compositional features of the **magmatic rocks** have been studied by KOLLER (1978, 1980 and in this vol.) in detail. In view of their immobile minor and rare earth element pattern, the gabbros are analogues partly of the upper and partly of the lower level gabbros of the known ophiolitic sequences. The majority of the greenschists of both types are analogues of ophiolitic basalts. The serpentinites can be regarded as metamorphic peridotites. Summarizing, the magmatic rocks of the Rechnitz Series can be derived from the oceanic lithosphere (KOLLER & PAHR, 1980).

The **main problems** concerning the geodynamic interpretation of the Rechnitz Series are as follows:

1. The general succession of the rocks is reverse than that of the ophiolitic sequences. Considering the dominantly gentle dip of the rocks over the whole area, the overturned position of the whole series appears to be unlikely.
2. Instead of the sheeted dyke and pillow lava complexes of normal ophiolitic sequences, thin-layered "tuffitic" and massive "basaltic" greenschists are present in the Rechnitz Series. The fine pyroclastic material of the "tuffites" may point to subaerial or at least shallow-marine eruption which is incompatible with the oceanic origin of the basalts.

For the above reasons an obvious discrepancy exists between the compositional and stratigraphical features of the Rechnitz Series. Serpentinite and gabbro lenses and blocks within the greenschist complex, however, could be considered not only as tectonic lenses but also as more or less deformed olistoliths, and the complex underlying the ophiolitic nappes may consist of olistostrome. The succession "normal sediments" – "olistostrome" – "nappe" is quite usual for orogenic sequences. Such a hypothesis could explain the "reverse" succession.

The "greenschist-problem" is a little bit more complex. The key to it is the interpretation of the fine-layered varieties. One of possibilities is to suppose that "tuffitic" layers and at least partly massive greenschists are of island arc origin while the massive greenschists of ophiolitic basalt composition could be considered as olistoliths or tetonic slices. Abundant analytical material (KOLLER, this vol.), however, supports ocean-floor tholeiite composition both of massive and thin-layered greenschists without any traces of island arc compositional features.

Another solution to the problem is to regard the fine-layered greenschists not as volcanogenic material accumulated synchronously with the eruption (that means tuffites) but as resedimented products of erosion of ophiolitic rocks. The appearance of such material in the sedimentary sequence may mark the beginning of the erosion of ophiolitic nappes or at least of the transportation of their detritus towards the Rechnitz "basin". The massive greenschists can be olistoliths as well as tectonic slices or even nappes. They could be derived from a sheeted dyke complex. The pillow lavas may have been eroded completely and their material redeposited in the thin-layered volcanomictic sediments.

In consequence, the above interpretation of the Rechnitz Series (Table) suggests that a progressive advancement of ophiolitic nappes took place towards the sedimentary basin. Reversed succession of overthrust fragments of the ophiolitic sequence can frequently be observed in many areas of the world. Summarizing, the Rechnitz Series as a whole shows a quite

Table: Synoptic interpretation of the Rechnitz Series.

Idealized rock-sequence after PAHR (1980b, 1982, 1984)	Pre-metamorphic complexes	Manifestation of ophiolitic rock matter	Mutual position of ophiolitic nappes and the sedimentary basin
Serpentinite	Tectonic nappes and slices	Overthrust	Direct connection
Metagabbro			
Massive greenschist			
Thin-layered greenschists with lenses of metamagmatites	Olistostrome	Input of slumping products	Neighbourhood
Thin-layered greenschists	Resedimented volcanic material	Prevailing input of erosional products	Progressive shortening of the distance
Chloritic phyllite, chloritic-calcareous phyllite etc.	Sediments with resedimented volcanic material	Subordinated input of erosional products	
Phyllite, calcareous phyllite, calcareous schists etc.	Pure sediments	No input of erosional products	?

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usual picture of an early orogenic sequence. Its Middle Cretaceous age (SCHÖNLAUB, 1973) points that the orogeny may have began in the Alpine realm earlier than it generally thought.

The regional **greenschist metamorphism** of the Rechnitz Serie is Tertiary in age (KOLLER & PAHR, 1980). In the metabasites traces of a high-pressure mineral assemblage was found (KOLLER, 1978). Hungarian (LELKES-FELVÁRI, 1982) and independently Austrian (KOLLER, this vol.) petrologists have shown that it is older than the greenschist metamorphism. This high-pressure metamorphism can be linked with subduction processes (PAHR, 1980b), probably, of Cretaceous age, like in the Tauern Window (SASSI et al., 1980).

To be more precise, the age of the **high-pressure metamorphism** in the Tauern Window (110 Ma = Aptian: SASSI et al., 1980) appears to be synchronous with the lower limit of the age of pure sediments in the Rechnitz Series (Aptian or younger: SCHÖNLAUB, 1973). From these data one can conclude that the volcanomictic sediments are younger than the high-pressure metamorphism, in other words, the olistoliths were already metamorphosed when they were carried into the sediments. Of course, the accuracy of the dating both of the sediments and the metamorphic events is not sufficiently precise to be sure in such conclusion. Its justifying, however, could point that the subduction in the Alpine realm began in the Early Cretaceous.

Finally, some words on the **correlation with the Carpathians**. Glaucophane grains in the heavy fraction of the insoluble residue of Urgonian limestones (Barremian to Aptian) from pebbles in the Cenomanian conglomerates of the Pieniny Klippen Belt (MIŠÍK, 1979) evidence pre-Barremian that means obviously Early (and not Middle or Late) Cretaceous subduction in the West Carpathian realm. The Middle Cretaceous flysch and probable olistostrome mark the beginning of the orogeny here. In the East Carpathians the Middle Cretaceous olistostrome (the Bucovinian Wildflysch) underlies the ophiolitic (Transylvanian) nappes (SĂNDULESCU et al., 1981). Such olistostromes and nappes can also be assumed in the West Carpathian realm (on the Pieniny Cordillera, from MIŠÍK's, 1979, data).

Consequently, if the above interpretation were true, the Rechnitz Series could serve as an important link between the Alps and Carpathians. The Tertiary greenschist metamorphism of the Rechnitz Series was due to a continent-continent collision, much earlier (Eocene) and much stronger than in the Carpathians (Miocene).

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