CHARACTER OF PERMIAN VOLCANOSEDIMENTARY SEQUENCES (MALUŽINÁ FORMATION) OF THE HRONICUM UNIT AT THE NE PART OF NÍZKE TATRY MTS.

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Abstract: The Malužiná formation represents a volcanosedimantary complex, consisting of polycyclic sequences from small to large sedimentary cycles (Vozárová & Vozár 1988). Thickness of this sequence reaches 2200-2400 m (Vozár in Karolus et. al 1969), and there are dominant clastic sediments accompanied by andesitic-basaltic lava flows and volcanoclastics. The monoclinally inclined sequence (15-40° to N) is characterised by cyclic repeating and thinning-upward ones. Deposits of the Malužiná formation be able to classified as two main alluvial systems: a) alluvium of braided rivers, b) alluvium of meandering rivers. This sequences probably represent fragment of filling basin – „red beds“ type. A several types of mineralizations occurs on the studied area. From point of view of genezis of uranium, disseminated type of copper mineralization and silica minerals, they represent the final stage of the Variscian epoch. The origin of later siderite, barite, hematite and vein type of copper mineralization indicate the relathionship with tectonic processes during the Alpine epoch.

Key words: Hronicum unit, Malužiná formation, litology, mineralization

Introduction

In this work bring lithological and mineralogical summary about the Permian volcanosedimentary sequences of the Hronicum unit, especially in domain of her biggest extension on the territory of the Western Carpathians.

Litology

Deposits of the Malužiná formation are classified as two main alluvial systems: a) alluvium of braided rivers, b) alluvium of meandering rivers. The sediments of braided alluvium represent typically coarse clastic conglomerates (Gms, Gm) and conglomerates with grain supporting structure (Gp, Gt, Gms) conglomerates occuring mostly in the lower parts of the beds. There are typical intraclasts of claystones and sandstones as products of autocyclic erosion and gradational bedding with normal arrangement as well. These unsorted conglomerates with supporting structure of sandy matrix belong into the category of mixed type of transport bed-load + suspended-load. The characteristic features are: - abundant erosional bases, - rarely also erosional channels with fining upward channel filling. Sediments with high proportion of matrix are red-coloured, sometimes there are large clasts of quartz „drowned" in fine-grained matrix. On the contrary, the gray sediments with lower contents of matrix are better sorted. If there are sandstones they represen massive and gradationally bedded, and exhibit flat, or sometimes even horizontal lamination. Proportion of the matrix suggests the mode and rate of sedimentation.

The meandering rivers sediments are charasterised by facies of sandstones (Se, Sh, Sl). The most common texture is a normal gradation and parallel current lamination, eventually flat cross-bedding (Sl). In the sandstones rarely occurre cavities after leeched concretions. These concretions (size from mm to 25cm), abundant in the finegrained sediments (Fl). The levee and floodplain deposits are present in a form of claystone-siltstone varietas (Fl) in upper parts of the cycles. The lamination and perhaps also other sedimentary textures in this type of sediments were destructed by bioturbation. The bioturbated horizons in upper parts of the cycles indicate low-energy environment, which was not stable and attacked by prograding sandy material at rythmical phase of transport. The floodplain deposits accumulated during the highstands might can have been temporarily exposed to terrestrial conditions; later they were reworked by inundation events. This might explain absence of such structures as ripple marks, mud cracking and other features documenting transitional or even terrestrial conditions. The occurrence of macroflora at the Kravany locality, documents such conditions that were identified as *Lebachia piniformis* (Schloth./Florin), fragments *Lepidophyta* and *Equisethophyta.*

The major volume of sediments were transported during floods. Due to different hydrodynamic conditions at highstands and lowstands they were constantly disturbed and reworked. The horizontal arrangement of the cycles were controlled by the extensional tectonics pronounced as the intraplate rifting; it suggest the thickness of the Malužiná formation (Vozárová & Vozár 1993).

Metamorphism of the Malužiná formation is equal to regional burial ones generally characterised by low-grade alteration (Vozárová & Vozár, 1988). Crystallinity of illite from the fine-grained sediments from the eastern part of studied locality (0,25 – 0,37 2Θ; Šucha & Eberl, 1992) indicates the anchimetamorphic overprint (150°C). Basal parts of the Malužiná formation (mostly the 1st and 2rd. megacycles) are often affected by intensive tectonic cleavage, that are nearly perpendicular to the bedding.

Tab. 1. Sedimentary facies of the Malužiná formation

Facies code after Miall (1985)	Sedimantary structures and textural characteristic of deposits	Interpretation
Gms	Massive or graded conglomerates and sandy conglomerates	Gravity flow deposits
Gm	Massive conglomerates and sandy conglomerates sometimes imbricated	Lag deposits, internal parts of the bars *upper flow regime*
Gt	Conglomeratic sandstone	Lag deposits, channel fill *upper flow regime*
Gp	Conglomeratic sandstone with planar crossbeds, cross-bedded gravel	Lag deposits, Transverse bars *upper flow regime*
Sh	Fine to coarse sandstones with horizontal lamination, often streaming lineation	Lag deposits Planar bed flow *upper flow regime*
Sl	Fine to medium sandstones with low angle crossbeds	Minor channel fills in *upper flow regime conditions*
Sp	Medium to coarse sandstones with planar crossbeds, often intraclasts and admixture of gravel	Transverse bars, side bars *Rythmical phase of transport*
Se	Fine sandstones with obscure crossbeds	Washout fill *lower flow regime*
Fl	Mudstones with horizontal lamination	floodplain deposits, *lower flow regime*

Mineralogy

A main types of mineralizations

A several types of metallic and non metallic mineralizations occures in the Permian volcanosedimentary complex of the Malužiná Fm (Fig.1). Poor metallic raw materials (excepting uranium mineralization) were occasionally exploited here in wide up to date scale.

Stratiform uranium mineralization is from the point of view of economic accumulations the only important. Occurences of this type of mineralization is relatively wide spread at whole studied area, but only Vikartovce, Kravany, Švábovce and Spišský Štiavnik deposits were mained on break through sixties and seventies years of last century (Veselý & Badár 1984). Mineralization is characterized: uraninite, accompained by chalcopyrite, tetrahedrite, tennantite, pyrite, sphalerite, galena, arsenopyrite, bornite, marcasite, Pb-Mo-S mineral, quartz, dolomite, calcite, autunite, torbernite, malachite, azurite, goethite. This mineral association occures in lacustrine and deltaic sediments (fine grained arkosic sandstones and arkoses) with abundant plant debris of the Kravany beds (Novotný & Badár 1971; Rojkovič 1997). The ore bodies form conformable lenses, generally up to 1.5 m thick, and they dip toward N and NE.

Two types of copper mineralization were distinguished on the studied area. Disseminated type of copper mineralization is occuring within the matrix of basalts, or in small quartz-carbonate lenses and amygdales (up to 2 m long and 20 cm thick) sets in basalts. Vein type of copper mineralization related to barite, barite-carbonate and quartz veins that are generally of E-W direction (up to 100 m long and 1m thick) located mostly in basalts, less in sandstones. Both types of copper mineralizations are the best developed at the Kvetnica, Lopušná Dolina valley and area of the Kozí Kameň Mts.. Chalcopyrite and bornite are predominant ore minerals, and they are accompained by tetrahedrite, tennantite, chalcocite, pyrite, marcasite, galena, sphalerite, siegenite, gersdorffite, carollite, hematite, rutile, leucoxene, covellite, malachite, azurite, iron hydroxides, jarosite and gyps (Ferenc & Rojkovič 2001).

Siderite-sulphidic mineralization is present only in the Vikartovce-Ždiarik locality. It occures in the Permian sandstones and quartzites. Most of main ore minerals represents tetrahedrite-tennantite group, and they are accompained by chalcopyrite, siderite, pyrite, and quartz is predominant gangue mineral. Mineralized structure is up to 0,2 m thick, with NNE direction and it`s dip toward E (Lehotský 1969, Slavkovský & Chovan 1996).

Quartz-hematite (spekularite) veins filling fissures in the Permian sandstones, and they occur in Bystrá Dolina valley at Spišské Bystré. (Lehotský l. c., Slavkovský & Chovan).

From non metallic mineralizations are the most significant barite mineralization and silica minerals. Except of barite mineralization, that is spatially related with vein type of copper mineralization (see thereinbefore), a debris of barite gangue were found on several places in the Permian sandstones to. Silica minerals are wide spread almost in all the Permian basalts and andesites, were they form fillings of amygdales and fissures. Silica minerals association reprezents: quartz, agate, jasper and chalcedony, accompained by epidote, chlorite, hematite, chalcopyrite, and others (Antaš 1963).

From point of view of genezis of uranium, disseminated type of copper mineralization and silica minerals, they represent the final stage of the Variscian epoch (Rojkovič 1990). The origin of later siderite, barite, hematite and vein type of copper mineralization indicate the relathionship with tectonic processes during the Alpine epoch (Slavkovský & Chovan 1996, Ferenc & Rojkovič 2001).

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