Beata Anna Naglik, M.Sc. Eng.

SUMMARY

Ph.D dissertation entitled: „Mineralogical and petrographical study of the clastic rocks from the Pepper Mts. (Sandomierz Upland) and the products of their alteration"

The Pepper Mts. are located in the central part of Poland, within the administrative boundary of the Sandomierz city. The Cambrian sedimentary rocks are exposed here in the topographic scarp adjacent to the Vistula River. The landscape of the Pepper Mts. was shaped by numerous landslides and erosion channels. Physical and chemical weathering was intensified by the southern exposure of the slopes and scarce vegetation. As a result of these processes the pepper-like color and structure of the cover was formed.

The Pepper Mts. represent a Cambrian structure exposed in the eastern part of the Holy Cross Mts. (Central Poland), which is the stratotype area for the Pepper Mts. Shale Formation (PMSF) - litostratigraphic unit defined by Orłowski (1975). A large complex built with clayey shales, mudstones and sandstones, deposited on both sides of the Holy Cross Fault (HCF), represents the sedimentary cycle, which started during the Neoproterozoic and ended by folding during Middle-Cambrian-Early Tremadocian (Kowalczewski, 1995). Inclusion the PMSF to the Łysogóry area or to Kielce Region is still the subject of discussion. Moreover, the stratigraphic interpretation of the succession is also difficult due to the scarcity of fossils and complicated tectonic situation.

The presented work was based on mineralogical and petrographical studies of rocks belonging to the PMSF. In order to reconstruct geological history of the succession, mineral assemblages were characterized from the genetic point of view. Pyrite and goethite were interpreted as products of sedimentary stage, while quartz, chlorite, kaolinite and calcite proved subsequent alteration due to the hydrothermal fluid circulation. Secondary sulphates (pickeringite, alunogen and epsomite) occurring on the pyrite-bearing rock outcrops marked the way of weathering processes.

The studies described above were carried out by using the following analytical techniques: optical transmitting light microscopy, scanning electron microscopy equipped with Energy Dispersive Spectroscopy detector (SEM-EDS), Raman microscopy, electron microprobe (EPMA), cathodoluminescence (SEM-CL). What is more, microthermometric studies of fluid inclusions were also applied.

In the light of results described above, it was assumed that sediments from the PMSF were formed in the shallow marine environment affected by freshwater inputs. The pyrite and goethite crystallized as a result of bacterial cells pseudomorphism during sedimentary stage. Primary mineral composition of analysed sediments was rebuilt due to the hydrothermal fluid circulation. The role of hydrothermal processes was proved by microthermometric studies of fluid inclusions trapped within euhedral quartz crystals. The pT conditions of the quartz crystallization with high temperatures up to 300°C and low pressure not exceeding the 30 atm are indicative for hydrothermal system. These values are much higher than expected for the diagenetic system without metamorphic changes, what may imply hydrothermal origin of quartz crystals. The hydrothermal fluid activity also caused the crystallization of chlorite. Temperatures of this process was documented on the basis of Bourdelle et al. (2013) goethermometry, which was based on the chemical composition of chlorite particles. Temperatures of kaolinite and calcite formation is unknown. Nevertheless, the hydrothermal origin of the kaolinite could be proved by high crystallinity of this mineral, documented by Raman spectroscopy. Hydrothermal activity caused thermal maturation of the organic matter from the host rocks. In the studied case the model of Kouketsu et al. (2014) was applied to establish thermal conditions of the process. This model defines the correlation between Raman spectra of organic matter and the temperature of inner maturity. High temperatures, exceeding the value of 200°C indicated that the PMSF should be referred to the Łysogóry area rather than Kielce region. Under hypergenic conditions, rocks from the PMSF underwent the physical and chemical weathering. As a result, a secondary sulphates mineral assemblage was forming. This assemblage consist of: pickeringite [$MgAl_2(SO_4)_4$* 22 H_2O], alunogen [$Al_2(SO_4)_3$*17 H_2O] and epsomite [$MgSO_4$ *7H_2O]. More detailed studies focused on the pickeringite particles as this mineral is rarely found on the territory of Poland.

To sum up, Ph.D dissertation entitled: „Mineralogical and petrographical study of the clastic rocks from the Pepper Mts. (Sandomierz Upland) and the products of their alteration" can be considered as the evolution history of the formation from sedimentary stage through hydrothermal transformation to the alteration under hypergenic conditions.