Alteration processes in acid pyroclastic rocks in Eastern Rhodopes, Bulgaria

Променителни процеси в кисели пирокластични скали в Източните Родопи, България

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Резюме. Представени са обобщени резултати от изследванията на разпространението и състава на киселите вулкански туфи в Източните Родопи. Характеризирани са отделните скални разновидности, както и процесите, довели до тяхното образуване, като широко се използват данни от експериментални изследвания на вулканските стъкла и продуктите на промяната им.

Key words: pyroclastic material, alteration processes, zeolitization.

Alteration of acid volcaniclastic hyaloclastic rocks (ash falls, pyroclastic flows and epiclastic rocks) with rhyolitic composition and at different conditions, lead to the formation of different alteration rocks. This work is based on the field and laboratory investigations of the pyroclastic rocks as well as on the experimental modeling of their origin.

The volcanic glass with rhyolitic composition is considered as a suppercooled melt. The disordered, nonequilibrium nature of the volcanic glass and its tendency towards ordering induce the processes of alteration during the initial, diagenetic stage. Thus is realized the hidden energy in the disordered state of the volcanic glass. The further alteration of diagenetically obtained crystal products requires an import of energy and occurs only when temperature rises.

During diagenesis three mineral components are formed: a layered silicate (smectites or celadonite), a

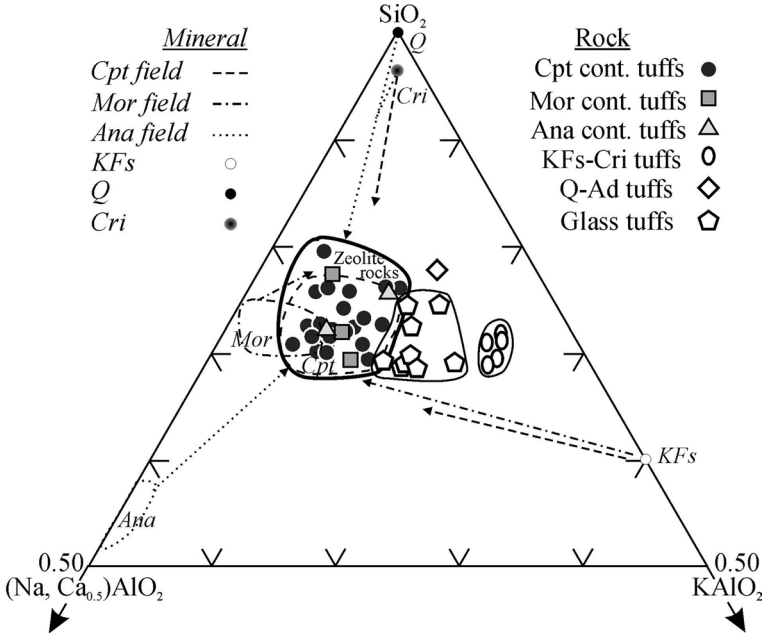

Fig. 1. Diagram of the chemical compositions of acidic volcanic tuffs and zeolite minerals from Eastern Rhodopes, Bulgaria

Chemical analyses after Kirov (1974), Kirov et al. (1976), Aleksiev and Djourova (1976, 1982), Aleksiev et al. (1997), Ivanova et al. (2001), Yanev et al. (2006) and unpublished analysis

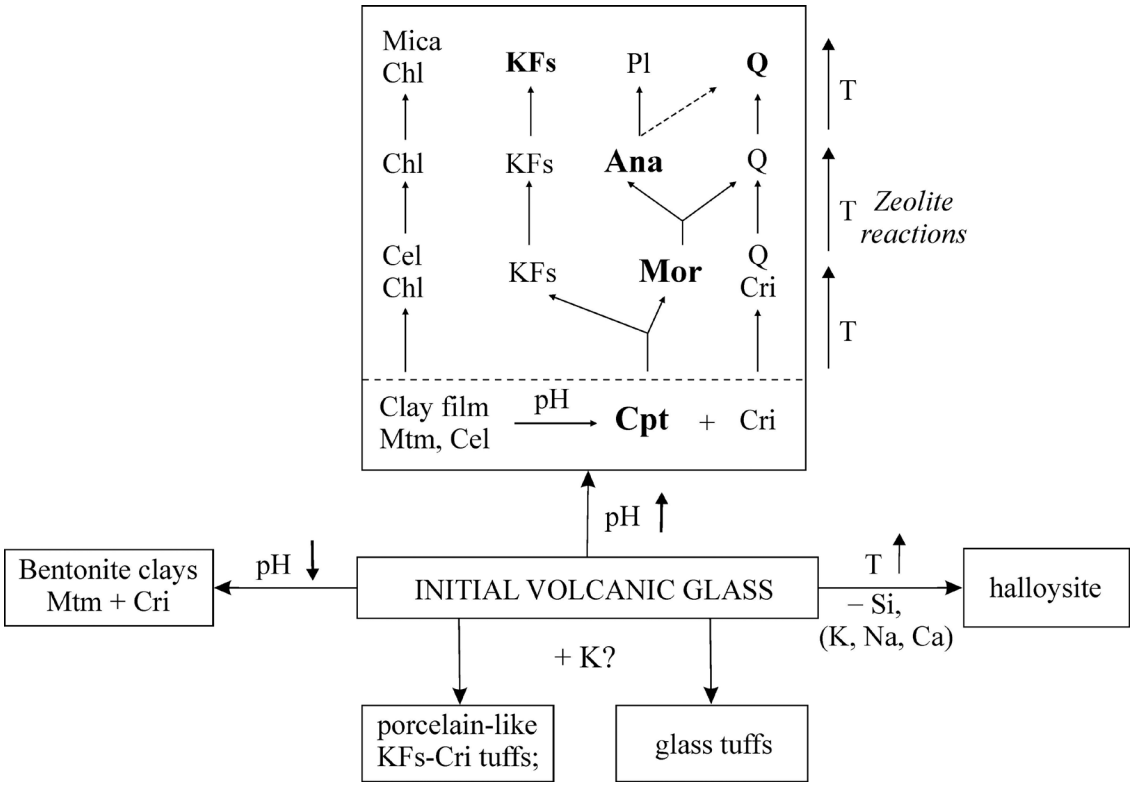

Fig. 2. Processes and products of the alteration of the acid pyroclastic rocks based on data from Eastern Rhodopes, Bulgaria

framework silicate (clinoptilolite) and a silica mineral (low-temperature cristobalite). With the temperature raising these minerals are transformed as follow: the clay minerals are transformed into chlorite and mica; clinoptilolite is unstable at high temperatures and it is replaced by mordenite with adularia and later into the analcime–adularia–quartz mineral association and the initially formed cristobalite is transformed into quartz. The chemical composition of all rocks of this sequence preserve approximately the composition of the clinoptilolite (Fig. 1), so we can infer that the system remains closed for the whole duration of the transformation, without an input or output of chemical components. The formation of the clay rocks is related to an output of alkaline and alkaline-earth elements and the genesis of the KFs-cristobalite rocks, with an input of potassium.

The modifications of the chemical composition of the rhyolitic pyroclastic rocks due to the formation of other alteration products are summarized in Fig. 2.

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