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Late Cretaceous Volcaniclastics in NW Turkey

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On the southwestern coast of the Black Sea, in the western Pontides Upper Cretaceous tuff layers are present. The tuffs are intercalated with limestones, marls and turbidites and were investigated with focus on their geochemistry, to get new insights to the arrangement of terranes and ocean basins at this time. In the region two Upper Cretaceous volcanic units can be distinguished, separated by distinct red pelagic limestone successions, belonging to the Unaz Formation. The lower volcanic unit is named Dereköy Formation and is Turonian to Santonian in age. It is thought to be deposited within extension structures, contemporaneously with rifting in the western Black Sea basin. The upper volcanic unit is called Cambu Formation. According to biostratigraphic data it is deposited throughout Campanian, when spreading in the western Black Sea basin started.

Interpreted as submarine deposits, element mobility has to be taken into account when interpreting geochemical ICP-MS data of the volcaniclastics. Multiple discrimination diagrams with suitable proxies elucidate the type of volcanism and contribute to reconstruction of the tectonic setting. The classified rock types range from basaltic to rhyodacitic in both volcanic formations. Basically degree of differentiation and alkalinity are the parameters looked at, when determining rock types of the volcanic eruption. Further volcanic series are specified as calc-alkaline to shoshonitic. Moreover, a volcanic arc setting seems to be the most likely case, following several discrimination diagrams, as well as normalized multi-element plots.

This tectonic setting can be discussed in connection with paleo-tectonic reconstructions. Most cited in literature nowadays are models favoring a northward subduction of the northern branch of Neotethys, creating an extensional setting north of the Pontides. This kind of back arc extension is interpreted as the reason of a southward drift of the Istanbul continental fragment from Eurasia and the following rifting and opening of the western and eastern Black Sea basin. The existence of a Pontide magmatic arc, as referred to in literature, is not precluded by the back-arc interpretation and should be further looked at, as geochemistry confirms a volcanic arc setting.

Correlation of the volcaniclastics with biostratigraphic events and ages from the same outcrops refers to a relative time span between Turonian and Campanian when the magmatic arc was active, at least. Further this correlation contributes to connecting particular outcrops with Dereköy or Cambu Formation. Consequently using these results Cambu Formation can be assigned as less alkaline and acidic then the lower volcanic succession. Furthermore the volcanic series seem to be more tholeiitic in the upper volcanic succession. Generally samples belonging to the Dereköy Formation are enriched in Zr, Th and Nb with respect to samples of Cambu formation.

The volcanic arc setting and the chemical characteristics of the volcanism, traced along the southwestern Black Sea coast as distinct tuff layers, are interesting mosaics in understanding paleogeography and paleoenvironmental changes in the Late Cretaceous.