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Petrographic and geochemical characterization of sandstones in upper level of ophiolitic melange in Central Pontides

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Abstract

Tectonic slices of different origins are observed in eastern of Kargı (Çorum). These slices, occurred via metamorphic units and lithologies of ophiolitic mélange which are observed with tectonic contact. The Çalarasın formation is observed at the upper levels of the ophiolitic mélange, which extends to the east of Kargı (Çorum) in the Central Pontides. The formation is composed of thin-bedded siltstone intercalated sandstone-shale and mudstone alternations. The sandstones of the formation include quartz, plagioclase, calcite, biotite, chlorite and volcanic rock particles. The sandstones were analyzed for geochemical properties and provenance traces, respectively. According to these analyzes, SiO_2 % is found between 26.46-71.78%, Al_2O_3% 5.22-10.86, Fe_2O_3% 2.89-7.11 and CaO% 6.13-36.02 respectively. When trace elements are evaluated, Sc content ranges from 76.13-201.03 ppm, and Y content ranges from 9.54-55.11 ppm. The sandstones are poor in terms of REE. It was determined that the sandstones were fed from the intermediate and mafic magmatic sources and tectonically represented the active continental margin and the island arc area.

Introduction

By acknowledging the geochemistry of sedimentary rocks, significant data can be obtained about the tectonic location, geochemical composition, origin and source area of the rocks [1-5]. In supplement, environmental interpretations can be represented by acknowledging petrographic characters. In these surveys, sandstones in sedimentary succession are usually preferred.

Pontides were established as part of the Alpine-Himalayan belt by Ketin [6], and Okay et al. [7] separated it into Istanbul, Strandja and Sakarya zones, respectively. The Pontides are geographically distributed as western, central and eastern Pontides. Yılmaz et al. [8] stated that the Pontides are the orogenic belt related to the opening and closing of the Tethys Ocean in the northernmost part of Turkey. As a result of this tectonic movement, a submarine turbidite basin was formed in the Central Pontides during the Early Cretaceous [9]. East of Kargı (Gökçedoğan), located in the Central Pontides, there are specific tectonostratigraphic sequences dwelling of lower and upper tectonic slices [10]. These slices are Pelitözü, Gölköy and ophiolitic melange slices respectively [11-12]. In the upper levels of the ophiolitic mélange, the Çalarasın formation consists of sedimentary rocks. This study revealed the petrographic and geochemical properties of the sandstones of the Çalarasın formation.

Material and Method

Thin sections and geochemical analyses of 7 samples collected from sandstone in the Çalarasın formation were performed in ITU-JAL (Table 1). The analysis results obtained were evaluated in diagrams.

Geology

The study area is located in a district where the Middle Jurassic and Cretaceous accretionary prism is still called the Central Pontides Supercomplex [13-15]. To the east of Kargı is in the Middle Jurassic accretionary complex, which has the Kirazbaşı complex consisting of ophiolitic mélange, and the Domuzdağ complex, whose metamorphic conditions change towards the north [16-17].

The Ophiolitic Melange of the Kirazbaşı complex consists of dunite and serpentinite at the base, and spilitic lava, metadiabase, meta basalt, radiolarite, chert, mudstone and pelagic limestones [16, 18] on the gabbro. At the top levels of the succession, there is the Çalarasın formation [18], which consists of alternating siltstone, sandstone, shale and mudstone respectively. The sandstones observed in the vicinity of Çalarasın district are brownish, reddish grey on the weathered surface, bright black in areas where the fresh fracture surface is altered, and brown and grey in localities where alteration is observed, unstable, medium-hard, fossil-free, poorly sorted and ungraded.

Petrography and Geochemistry

In the thin section review of the sandstones in Beşpınar, it is recognized that there are many volcanic rock fragments in the rock. There are mainly quartz, plagioclase, calcite and rock particles. Grains are medium well, rounded, poorly sorted and ungraded. Quartz exists as monocrystalline. Calcite is in the matrix, and secondary quartz and iron oxide minerals are emplaced in its fractures and cracks. It was observed to be fed from volcanic rocks during the deposition. Corresponding to Folk [19], the rock was determined as lithic arenite because the quartz content is less than 90%, the rock particle is more than feldspar, and the matrix ratio is less than 15%.

To reveal the provenance traces of the sandstones, the diagram was prepared using the main oxide values [20]. According to the prepared diagram, it was determined that the sandstones were fed from intermediate and mafic magmatic sources (Figure 2). For sandstones, most of the samples examined in the (Fe_2O_3+MgO)−TiO_2 diagram [1] are distributed outside the defined areas (Figure 3a). Only one specimen is located in the active continental margin area. In the (Fe_2O_3+MgO)−(Al_2O_3/SiO_2) diagram [1], many samples fall into the active continental margin area (Figure 3b). In the La/Th variation diagram developed by Bhatia and Crook [2], the samples fall into the island arc area (Figure 3c). The samples fall into the island arc area in the Th-Co-Zr/10 diagram (Figure 3d).

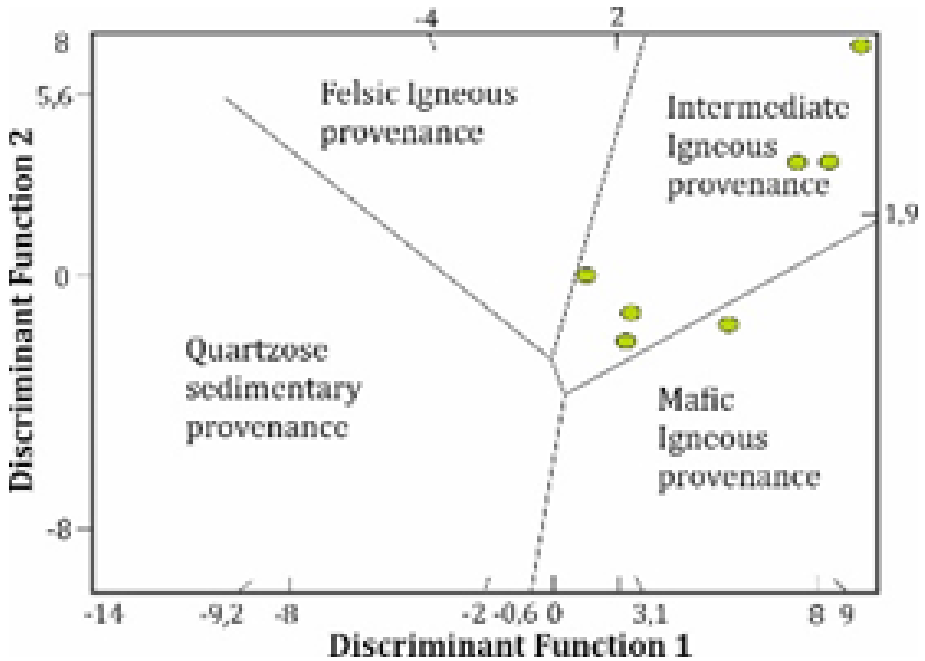

Figure 2. Geotectonic discrimination diagram for provenance of sandstones by major elements [20]

Conclusion

The petrographic and geochemical characteristics of the sandstones, which are located in an extremely complex area and represent the upper levels of the lithologies belonging to the ophiolitic melange, have been revealed. As a result of the study, it was determined that the sandstones interpreted as lithic arenite were fed from intermediate and mafic magmatic sources and concentrated in the tectonically active continental area and island arc area. More detailed environment interpretations will be possible by increasing the analysis in different diagrams.

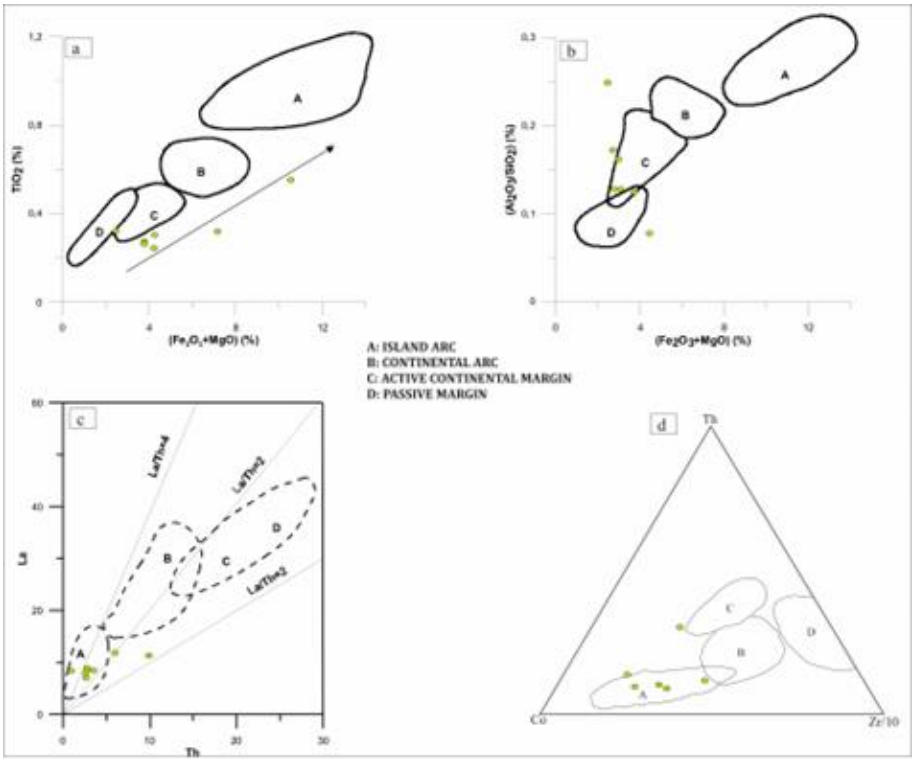

Figure 4. Geotectonic diagrams of sandstones

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