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Origin of dolomite in the Late Jurassic platform carbonates, Bolkar Mountains, Central Taurides, Turkey: Petrographic and geochemical evidence

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ABSTRACT

The Late Jurassic-early Senonian Cehennemdere Formation extending in an E-W direction in a wide area at the south of the Bolkar Mountains (Central Taurides, Turkey) is composed of platform carbonates. The formation was deposited in an environment that was being transformed from a shallow carbonate platform to an open shelf and a continental slope, and was buried until late Paleocene uplift. The formation, with a thickness of about 360 m, was chiefly developed as textures consisting of mudstone and wackestone and has been commonly dolomitized. Based on petrographic and geochemical properties, four types of replacement dolomites and two types of dolomite cements were distinguished. Replacement dolomite (RD), which is cut by low-amplitude stylolites developed as (1) fine crystalline planar-s dolomite (RD1); (2) medium crystalline planar-s dolomite (RD2); (3) medium-coarse crystalline planar-e dolomite (RD3) and; (4) coarse crystalline planar-s (e) dolomite (RD4). Two types of dolomite cements (CD) observed in low abundance and overlie low-amplitude stylolites: (1) coarse crystalline dolomite cement (CD1) filling dissolution voids and fractures in RD1 dolomites, and; (2) rim dolomite cement (CD2) that commonly develops on the space-facing surfaces of RD4 dolomite. Replacement dolomites are non-stoichiometric ($Ca_{54-59}Mg_{41-46}$), have similar geochemical properties, and are generally dull red/non luminescent in appearance. Replacement dolomite is represented by $\delta^{18}O$ values from −4.5 to −0.5‰ VPDB, $\delta^{13}C$ values of −0.7 to 2.7‰ VPDB, and $^{87}Sr/^{86}Sr$ ratios ranging from 0.707178 to 0.707692. Petrographic and geochemical data indicate that replacement dolomite (particularly RD2, RD3, and RD4 dolomite) was formed at shallow-intermediate burial depths during the Late Jurassic-Early Cretaceous, from seawater and/or from slightly modified seawater. The replacement dolomite (RD) was then recrystallized at increased burial depths and temperatures. Dolomite cements are similar to replacement dolomites in that they are non-stoichiometric ($Ca_{55}Mg_{45}$) and have similar trace element compositions. CD1 dolomite, which cuts low-amplitude stylolites, was formed during intermediate to deep burial following stylolite development. CD2 dolomite was precipitated in intercrystal pores in association with RD4 dolomite. Remaining pore space was filled with bitumen.

1. Introduction

The Central Taurides is geographically defined as the area between two major strike-slip faults, namely, the Kırkkavak fault in the west and the Ecemiş fault in the east (Özgül, 1984; Fig. 1). The Central Taurides, having all the characteristics of the Tauride belt, were studied by several workers (Özgül and Arpat, 1973; Özgül, 1984; Demirtaşlı, 1984; Demirtaşlı et al., 1984; Robertson, 2000; Parlak and Robertson, 2004 and many others). These studies indicated that the Central Taurides are composed of a number of tectono-stratigraphic rock units with distinctive stratigraphical, structural, and metamorphic features (Özgül, 1976, 1984).

The study area is located at the south of the Bolkar Mountains (Central Taurides, Turkey) (Fig. 1). In the study area, formations belong to the Aladağ Unit crops out. The Aladağ Unit is represented by clastic and carbonate rocks formed in a shelf environment from Late Devonian- to Late Cretaceous and, by turbidites deposited on a continental rise-basin plain during Late Cretaceous-Early Paleocene (Özgül, 1976, 1984; Demirtaşlı et al., 1984; Tekeli et al., 1984). The Jurassic-early Senonian Cehennemdere Formation is a number Aladağ Unit and aligns in an E-W direction in a wide area at the south of the Bolkar Mountains is comprises platform carbonates (Özgül, 1976; Demirtaşlı, 1984; Demirtaşlı et al., 1984; Koç et al., 2005). The formation attains a thickness of about 360 m and was chiefly deposited as mudstones and wackestones, and has been extensively dolomitized.

A limited number of studies on the dolomitization of the Cehennemdere Formation are available (e.g. Varol and Magaritz, 1992),

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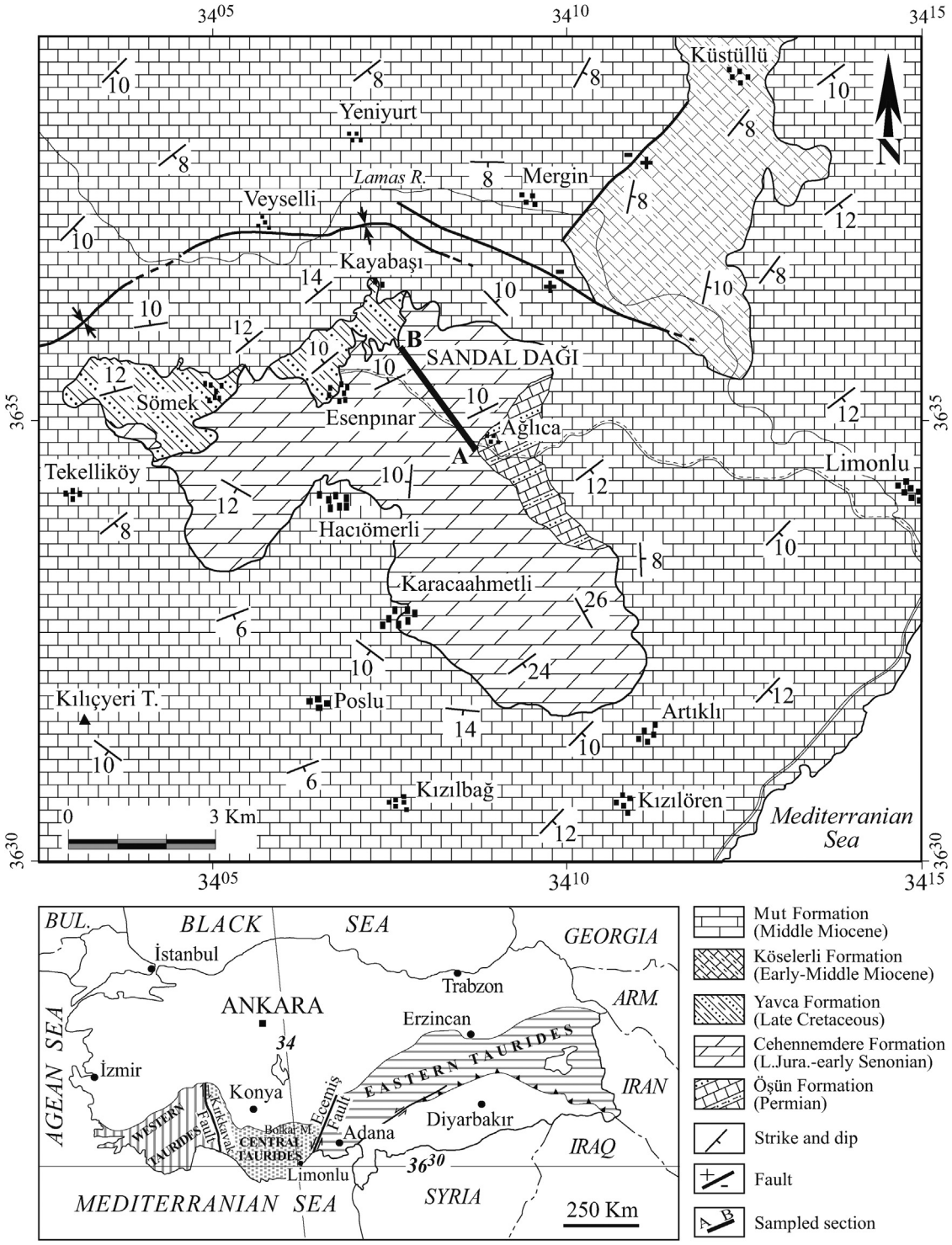

Fig. 1. (A) The broad geographical subdivision of the Taurus Belt (after Özgül, 1984), (B) Geological map and generalized stratigraphic columnar section of the Sandal Mountain area, Central Taurus, Sourth Turkey (after İlker, 1975).

and data in these works are not sufficient to explain the origin of dolomitization. This study is the first attempt to describe the origin of pervasive dolomitization of platform carbonates in the Cehennemdere Formation at the south of the Bolkar Mountains. The aim of this study is to determine: (1) characteristics of different dolomite phases, (2) geochemistry of each dolomite phases, (3) the source of dolomite-forming fluids, and (4) relative age of dolomite in relation to the burial history.

2. Stratigraphy

A sequence having five formations ranging from Permian to Middle Miocene in age crop out in the study are. The Permian Öşün Formation occurring at the base of this sequence (Fig. 1), from bottom to top, is represented by quartz-sandstone with interlayered biomicrite, sandy limestone to limestone, and sandstone-shale package with dolomite interbeds and crystallized limestones. The