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Hydrogeological, hydrogeochemical and isotope geochemical faetures of thermal waters in Kuşadası, Turkey

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Abstract

In this study, the hydrogeological, hydrogeochemical and isotopic signatures of the thermal waters in Kuşadası and surroundings will be presented. In the study area, the basement rocks are impermeable Paleozoic mica schists of the Menderes Massif. The Mesozoic marbles are ascribed either to groundwater aquifers or to thermal waters reservoirs. These rocks are covered by the Kuşadası formation consisting of a sequence of claystones, conglomerates and carbonate rocks. This upper Kuşadası formation plays an important role as cap rocks. The existence of active faults and basic volcanic rocks of Pliocene age points to the existence of high heat flows and geothermal gradients. As a youngest geological formation, the alluvium is a very good aquifer. Nowadays, there is the risk of sea water intrusion into the local groundwaters due to the drop of groundwater table caused by groundwater overexploitation in the study area.

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Keywords: Turkey, Western Anatolia, Aydın, Kuşadası, Davutlar, groundwaters, sea water intrusion, geothermal waters.

1. Introduction

Most of the research on geothermal resources in Turkey has been carried out in continental rift zones of the Menderes Massif, mainly in the rift zone of the Büyük Menderes area[1] (Fig. 1). In this area, a 750 MWe potential of geothermal energy production is expected to be achieved by 2018[2,3]. In the study area, (i) a 1: 25.000 scale geological map was reconstructed, (ii) hydrogeological location and features of geothermal waters were identified comprehensively, (iii) the groundwaters and geothermal waters have been described hydrogeochemically, and (iv) the origin of groundwaters and geothermal waters was explained. Finally, the intrusion of sea water into groundwaters in Kuşadası and surroundings has been recognized due to the drop of groundwater table caused by the excessive use of groundwaters in the study area.

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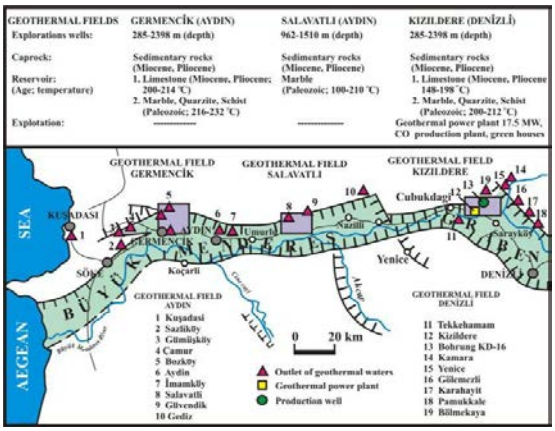

Fig. 1. The continental rift zone of the Büyük Menderes, with the location of the geothermal waters. Adapted from[1].

2. Geologic setting

In the area under research, a great number of geological, hydrogeological and hydrogeochemical studies have been carried out from 1978 to nowadays[4,5,6,7]. As a result, a 1: 100.000 scale geological map of Kuşadası and surroundings was completed in 2000. The Mesozoic metamorphic schists consist of alternation of muscovite-biotite schists, quartz schists and calc schists, which are concordant with marbles[3] (Fig. 2). The marbles are medium-thick layered, have intense fractures, karst holes and schist lenses, and are of Upper Triassic to Upper Cretaceous age[3]. The Miocene to Pliocene Kuşadası formation, known as lake sediments, overlies discordantly metamorphic rocks. Neogene volcanic rocks in the area crosscut the metamorphic rocks and Kuşadası formation. The Kuşadası formation and its surroundings are covered by widespread youngest alluvium made up of gravels, sands and clays.

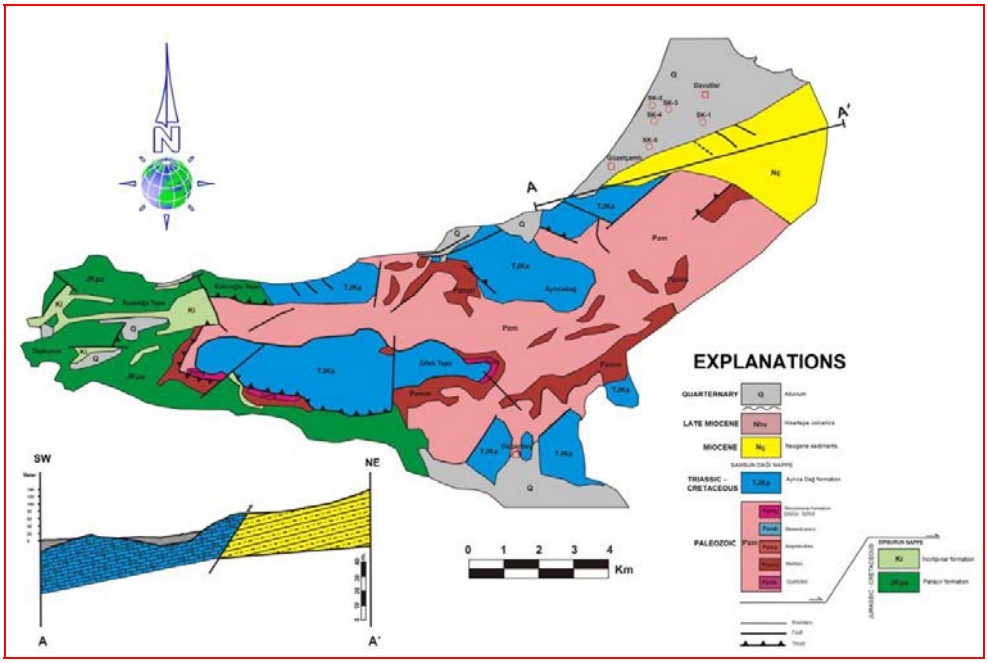

Fig 2. Geological map and cross section of Kuşadası and surroundings. Taken from[3].