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Developmental and environmental effects of the Kızıldere geothermal power project, Turkey

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Abstract

Calcite scaling in the wells and the high boron concentration in the produced fluids are a major problem in the Kızıldere geothermal field. Scaling is minimized by controlling wellhead pressures and by mechanically removing the deposits periodically. Silica scaling would be a potential problem were reinjection to be introduced. Currently the spent geothermal water is discharged into the nearby Büyük Menderes River, which might prove harmful to plants and crops downriver. The new disposal methods currently being developed include reinjection, removal of boron by chemical treatment, and transportation to the Aegean Sea. Technically and economically, reinjection seems to be the most suitable option, and might also improve steam production. Another potential environmental problem at Kızıldere is the high carbon dioxide content (1–3% by weight) in the produced fluid. This has a significant impact on the output of the power plant turbogenerator, and on the performance of its condenser. However, the gas discharged from the condenser has high purity, and is piped to an adjacent plant where minor impurities are removed. This plant currently produces 120,000 t/year of industrial-grade carbon dioxide, which provides more than 90% of Turkey's requirements for carbonated soft drinks. Thus, a potentially major environmental problem has been turned into a benefit.

Keywords: Exploitation; Calcite scaling; Boron; Carbon dioxide; Fluid disposal; Kızıldere; Turkey

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1. Introduction

More than 50% of the energy consumed in Turkey is derived from expensive imported oil; the electric energy and heat produced from geothermal resources have, however, proved to be cheaper. Because geothermal energy is cheap, clean, sustainable, indigenous and can be used in integrated utilization schemes, it is important that it be developed on a wider scale.

The Kızıldere geothermal field is located 40 km west of the city of Denizli, in the eastern part of the Büyük Menderes Graben (Fig. 1). It was the first known high-temperature geothermal field in Turkey, and was discovered and developed as part of a cooperative project between the Mineral Research and Exploration General Directorate (MTA) of the Turkish government and the United Nations Development Programme (UNDP). In 1984, the Turkish Electricity Authority (TEAS) installed a single-flash power plant with 20 MWe capacity. The geothermal fluids are also used to heat greenhouses covering a total area of 6000 m^2. As far as geothermal energy potential is concerned, Kızıldere is at present the most important geothermal field in Turkey. Although geothermal offers many advantages over fossil fuels as an energy source it is not entirely without environmental problems. This paper describes some of the problems at Kızıldere and the steps being taken to overcome them.

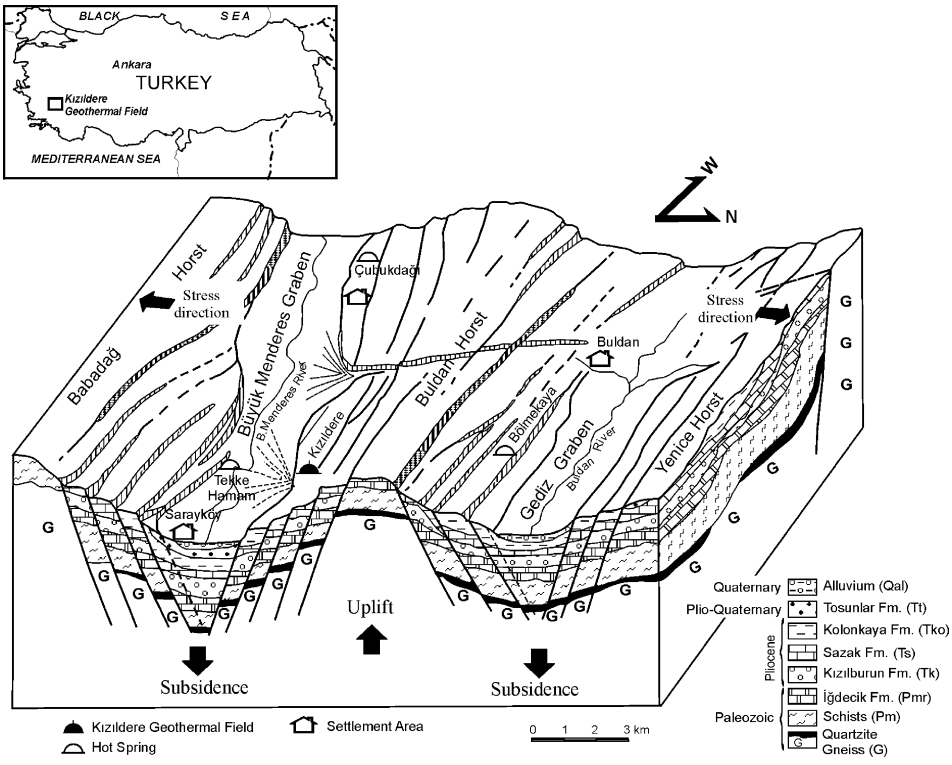

Fig. 1. Geological block diagram of the Sarayköy–Buldan area (from Şimşek, 1985).