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Engineering Geology 80 (2005) 260–270

ENGINEERING GEOLOGY

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Geologic and geotechnical effects of an impact caused by an airplane crash

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Received 18 October 2004; received in revised form 23 May 2005; accepted 3 June 2005
Available online 25 July 2005

Abstract

A Turkish Airlines (THY) Boeing 737-400 plane crashed into alluvial soils creating an approximately 13 m deep and 30 m wide crater near the village of Adatepe, Ceyhan in southern Turkey. Effects of the impact on the soils in and around the crater were investigated from both the geological and soil mechanics point of view.

The results show that the impact caused severe deformations in the soils in and around the crater. The soils deformed similar to metamorphic rocks seen at many terrestrial hypervelocity impact craters around the world and became overconsolidated up to a distance of about 10 m from the crater wall as a result of the impact.

Also, the crash was recorded as a 2.7 magnitude earthquake by a nearby microtremor seismograph which provided both the location (epicenter) and time of the crash which was not known immediately after the crash.

Keywords: Airplane crash; Impact; Earthquake; Overconsolidation; Preconsolidation pressure; Overconsolidation ratio

1. Introduction

A Turkish Airlines (THY) Boeing 737-400 plane crashed a short while after it took off from the southern city of Adana, Turkey, early morning on April 7, 1999, resulting in the deaths of all six of its crew members. No passengers were aboard. The plane departed for Jeddah, Saudi Arabia at 00:36 h to bring back Turkish pilgrims performing their hadj (visiting Mecca during Ramadan).

The plane crashed into a field about 500 m northeast of the village of Adatepe 5 km east of the town of Ceyhan, creating an approximately 13 m deep and 30 m wide crater in the soils of the alluvial planes of the Ceyhan river nearby (Figs. 1 and 2). Pieces of its tail (horizontal and vertical stabilizers) were found next to the railroad about 2 km west of the crash site.

After inspecting the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR), the officials

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doi:10.1016/j.enggeo.2005.06.003

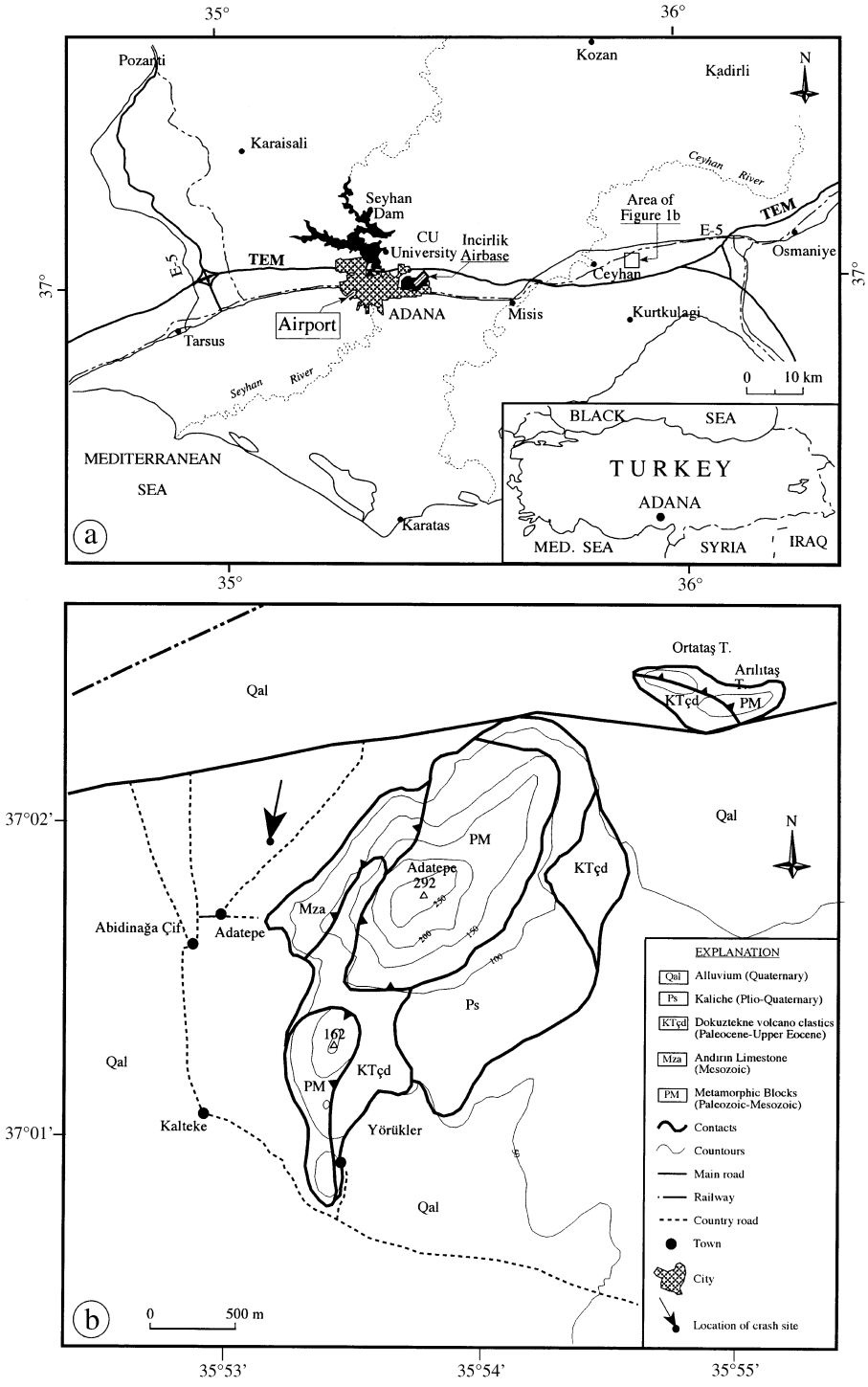

Fig. 1. Location (a) and geologic map (b) of the study area. Geology is adopted from Kozlu (1997).