



Cimmerian evolution of the Central Iranian basement: Evidence from metamorphic units of the Kashmar–Kerman Tectonic Zone

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ABSTRACT

The Kashmar–Kerman Tectonic Zone (KKTZ) is an arcuate zone located between the Tabas and Yazd blocks in Central Iran. Detailed structural analysis and mapping of the metamorphic basement rocks of the KKTZ on the Boneh-Shurow, Tashk, Saghand and Sarkuh Metamorphic Complexes, as well as ⁴⁰Ar/³⁹Ar cooling ages on the Boneh-Shurow Metamorphic Complex indicate three deformation stages in the tectonometamorphic evolution of the KKTZ during the Cimmerian orogeny. The D₁₋₁ event corresponds to continental accretion through the progressive formation of dextral shear zones, which is equivalent to an Early Cimmerian event during Late Triassic–Early Jurassic times. The D₁₋₂ event is characterized by top-to-NE normal shear zones due to syn-collisional exhumation within the KKTZ and is considered to be a Mid-Cimmerian Middle Jurassic event at ca. 168 Ma. The progressive regional compressional deformation is continued by the D₂₋₁ and D₂₋₂ events through formation of reverse shear zones and faults, with their SW movement. The progressive D₂ event is considered to be Late Cimmerian and has taken place during Early Cretaceous. It is proposed that the mapped long-lived dextral shear zones within the KKTZ acted as block bounding faults between the Tabas and Yazd blocks in Central Iran.

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1. Introduction

The Central Iranian Terrane consists of three north–south oriented crustal domains, called the Lut, Tabas and Yazd blocks, which are today aligned from east to west, respectively (Fig. 1). The Tabas and Yazd blocks are separated by a long, arcuate and structurally complex belt defined as the Kashmar–Kerman Tectonic Zone (KKTZ) (Haghipour and Pelissier, 1977; Ramezani and Tucker, 2003) (Fig. 1c). Unlike the neighbouring Tabas and Yazd blocks, the KKTZ provides remarkable exposures of the deeper crustal levels with Upper Neoproterozoic and Lower Paleozoic rocks.

Widespread metamorphic complexes are distributed within the KKTZ (Fig. 1). The Chapedony Metamorphic Complex on the western parts of the KKTZ (Fig. 1b and c) has been related to the Eocene metamorphic core complexes during Eurasia–Arabia collision by several authors (Kargaranbafghi et al., 2006, 2012; Ramezani and Tucker, 2003; Verdel et al., 2007; Yassaghi and Masoodi, 2011). However, metamorphic complexes on the eastern parts of the KKTZ (i.e., the Boneh-Shurow, Tashk, Saghand and Sarkuh Metamorphic Complexes) (Figs. 1c and 2a) are not studied in detail. Though the timing of their

initial metamorphism has attributed to Neoproterozoic events (Pb–Pb isochron ages; Huckriede et al., 1962) and the latest Neoproterozoic–Early Cambrian events (U–Pb zircon age; Ramezani and Tucker, 2003), the timing and mechanisms of subsequent Paleozoic and Mesozoic deformation and metamorphic events are not constrained.

In this paper, we present the results of field and analytical work in the metamorphic complexes exposed within the eastern part of the KKTZ (Figs. 1c and 2a), where major transtensive and transpressive dextral shear zones as well as several major reverse faults are mapped. In addition, detailed structural maps, mesoscopic structural observations, microfabrics of mylonite and ⁴⁰Ar/³⁹Ar mineral ages are also presented. Our new data underline the significance of the Mesozoic tectonometamorphic evolution of the complexes during the Cimmerian orogeny forming the basement of Central Iranian Terrane. This also provides constraints on the tectonic evolution of the Paleotethyan Ocean during the Cimmerian events.

2. Regional tectonic setting

The Central Iranian Terrane is located within the Alpine-Himalayan orogenic system and is part of the larger Cimmerian continent, which evolved during the closure of the Paleotethys Ocean (e.g. Sengör, 1987; Stöcklin, 1968) (Fig. 1a). This terrane, together with other Cimmerian blocks in Iran (Alborz and Sanandaj–Sirjan zone), is situated to the

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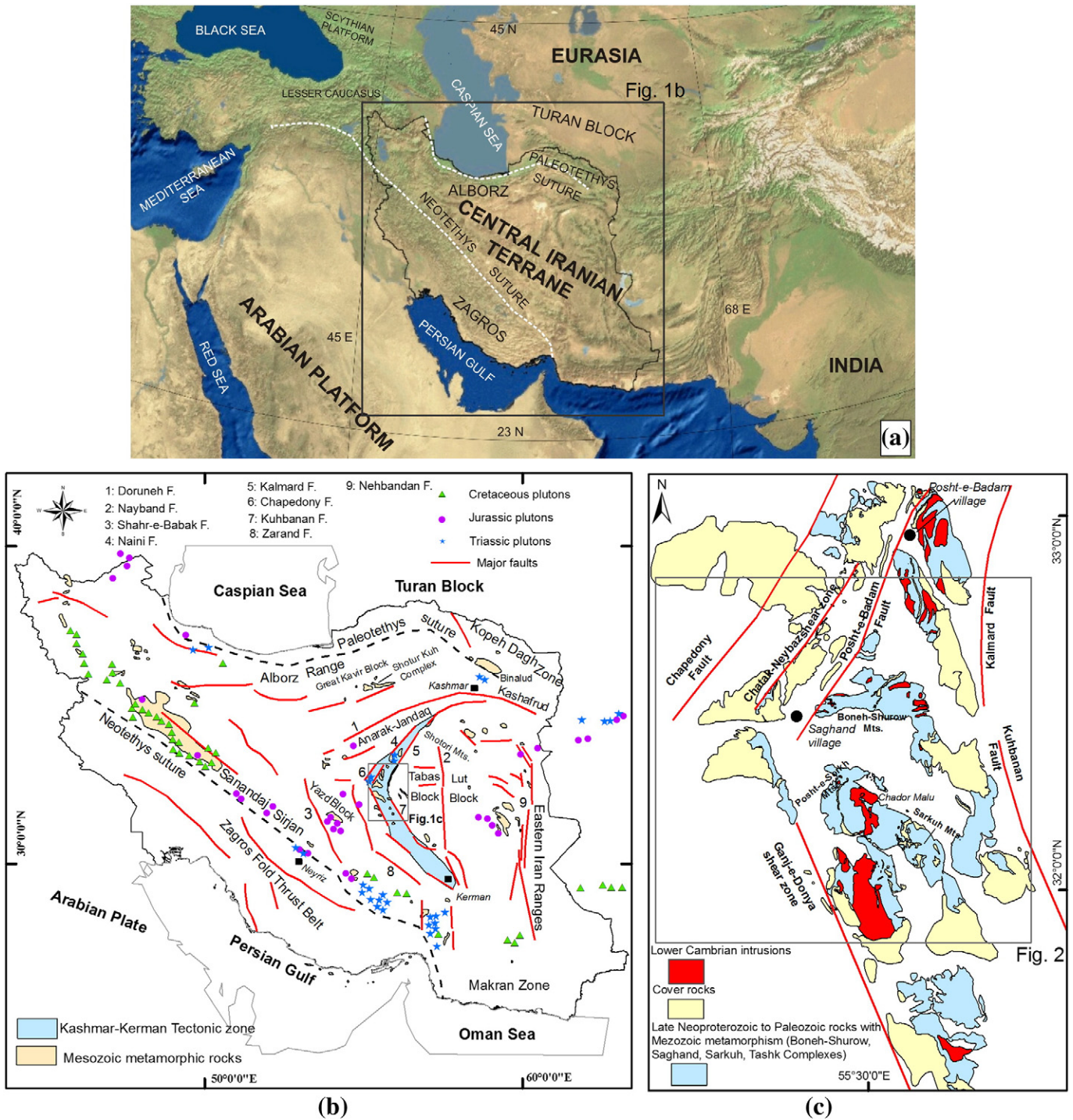


Fig. 1. (a) Regional map depicting topography, mountain belts, and tectonic features of the Middle East and south-central Eurasia (after Guest et al., 2006). (b) Simplified tectonic map of Iran and its constituent crustal blocks containing important faults, distribution of Mesozoic plutons and metamorphic rocks, as well as the location of the study area, i. e., the Kashmar Kerman Tectonic Zone (KKTZ) shown in grey color (compiled from Berberian and King, 1981; Jackson and McKenzie, 1984; Haghypour and Aghanabati, 1989; Alavi, 1991). (c) Simplified geological overview map of the KKTZ showing the distribution of the metamorphic basement units and its cover rocks. The rectangle shows the location of Fig. 2.

northeast of the Zagros-Makran Neo-Tethyan suture zone (Stöcklin, 1968) (Fig. 1b).

Beginning in the Early Permian, a long strip of continental blocks, consisting of parts of Turkey and Iran (Cimmerian continent/blocks), detached from northern Gondwana (Brunet et al., 2009). A relatively rapid northward drift brought the Cimmerian continental blocks across of Paleotethys during Early Permian to Late Early Triassic (Muttoni et al., 2009). The collision of Iran and of other ‘Cimmerian’ blocks against southern Asia resulted in the Eo-Cimmerian orogeny (Stille, 1910), which led

to the closure of the Paleozoic Paleotethys ocean (Berberian and King, 1981; Sengör, 1990; Stampfli and Borel, 2002). The younger age limit of this collision is Late Triassic (Zanchi et al., 2006). Back-arc spreading of the Cimmerian blocks was induced by the northeast-directed subduction of the Neotethys ocean (Bagheri and Stampfli, 2008; Ramezani and Tucker, 2003) resulting in the Middle Cimmerian orogenic event during the Middle Jurassic (Fürsich et al., 2009; Wilmsen et al., 2009a).

Takin (1972) was the first to describe the concept of a distinct, fault-bounded ‘Central and East Iranian Microcontinent’ for the Central

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