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Provenance of the Walash-Naopurdan back-arc–arc clastic sequences in the Iraqi Zagros Suture Zone

Sarmad A. Ali [a, b], Rajaa S. Sleabi [a], Mohammad J.A. Talabani [a], Brian G. Jones [b, *]

[a] Department of Applied Geology, College of Science, Kirkuk University, Kirkuk, 36001, Iraq
[b] GeoQuEST Research Centre, School of Earth & Environmental Sciences, University of Wollongong, NSW, 2522, Australia

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ABSTRACT

Marine clastic rocks occurring in the Walash and Naopurdan Groups in the Hasanbag and Qalander areas, Kurdistan region, Iraqi Zagros Suture Zone, are lithic arenites with high proportions of volcanic rock fragments. Geochemical classification of the Eocene Walash and Oligocene Naopurdan clastic rocks indicates that they were mainly derived from associated sub-alkaline basalt and andesitic basalt in back-arc and island arc tectonic settings. Major and trace element geochemical data reveal that the Naopurdan samples are chemically less mature than the Walash samples and both were subjected to moderate weathering. The seaway in the southern Neotethys Ocean was shallow during both Eocene and Oligocene permitting mixing of sediment from the volcanic arcs with sediment derived from the Arabian continental margin. The Walash and Naopurdan clastic rocks enhance an earlier tectonic model of the Zagros Suture Zone with their deposition occurring during the Eocene Walash calc-alkaline back-arc magmatism and Early Oligocene Naopurdan island arc magmatism in the final stages of intra-oceanic subduction before the Miocene closure and obduction of the Neotethys basin.

1. Introduction

The Zagros Suture Zone in northern and northeastern Iraq includes overriding nappes of ophiolite complexes, layered and pillow lavas, and Tertiary sedimentary deposits (Buday, 1980). All these units are separated by crush zones and thrusts (Bolton, 1958; Ali et al., 2013). Geologically, the study areas comprise the Naopurdan and Walash Groups (Jassim and Goff, 2006) that were deposited during subduction events accompanying closure of the Neotethys Ocean. Clastic rocks occurring in the Eocene Walash and Early Oligocene Naopurdan Groups in northern Iraq provide vital information for understanding the location and evolution of volcanic segments in the southern Neotethys Ocean and to determine the nature of the collision between the Arabian and Eurasian continental plates (Saura et al., 2011).

The Walash and Naopurdan volcano sedimentary sequences in the Zagros Suture Zone reveal the nature of the final depositional stages in the Neotethys Ocean prior to its closure. The tectonic setting of sedimentary basins and their palaeoclimate conditions can be assessed from a combination of petrographic and geochemical data (e.g., Dickinson and Suczek, 1979; Bhatia, 1983; Valloni and Mezzardi, 1984; Bhatia and Crook, 1986; McLennan et al., 1993; McLennan, 2001; Armstrong-Altrin and Verma, 2005; Garzanti et al., 2007; Perri et al., 2016). Although some geochemical parameters can be modified during weathering (Taylor and McLennan, 1985; Perri, 2014; Perri et al., 2016) and/or diagenesis (Nesbitt and Young, 1982; Milodowski and Zalasiewicz, 1991), the immobile elements in the rock are not significantly affected. The underlying assumption for using geochemical discrimination diagrams with sedimentary rocks is that there is a close link between plate tectonic setting and sediment provenance (e.g., Kroonenberg, 1994; Zimmermann and Bahlburg, 2003; Armstrong-Altrin and Verma, 2005; Etemad-Saeed et al., 2011).

This paper aims to assess the source and depositional setting of the Eocene to Oligocene volcano-sedimentary successions in the southern portion of the Neotethys Ocean prior to their emplacement in the Zagros Suture Zone.

2. Regional geological setting

The Kurdistan region of northeast Iraq, near the Iraqi-Iranian

* Corresponding author.
E-mail addresses: sarmad@uow.edu.au (S.A. Ali), rajaa_alubaidy@yahoo.com (R.S. Sleabi), mj_jamil_geo@yahoo.com (M.J.A. Talabani), briangj@uow.edu.au (B.G. Jones).

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border (Fig. 1), consists of rugged mountains with an irregular steep dendritic drainage pattern superimposed on a structurally complex area are dominated by folding and thrusting (Buday, 1980). The Zagros Orogen can be subdivided into four subparallel tectonic zones: the Ueumich-Dokhtar Magmatic Arc, the Sanandaj-Sirjan Zone. The Zagros Fold and Thrust Belt and the Mesopotamian Foreland Basin (Berberian and King, 1981; Alavi, 1994; Mohammad et al., 2014). The study area forms part of the western Zagros Fold-Thrust Belt, which developed as a response to the ongoing collision between the Arabian and Iranian plates with the consumption of Neotethys (Ali et al., 2012). Faults and folds have been observed in both Iran (e.g. Stockline, 1968; Berberian and King, 1981; Alavi, 1994, 2004; Saura et al., 2011) and Iraq (Aswad, 1999; Jassim and Goff, 2006; Ali et al., 2013; Aswad et al., 2014. The structural relationships between these tectonic units provide evidence for the interpretation of the western Zagros Suture Zone (Fig. 2).

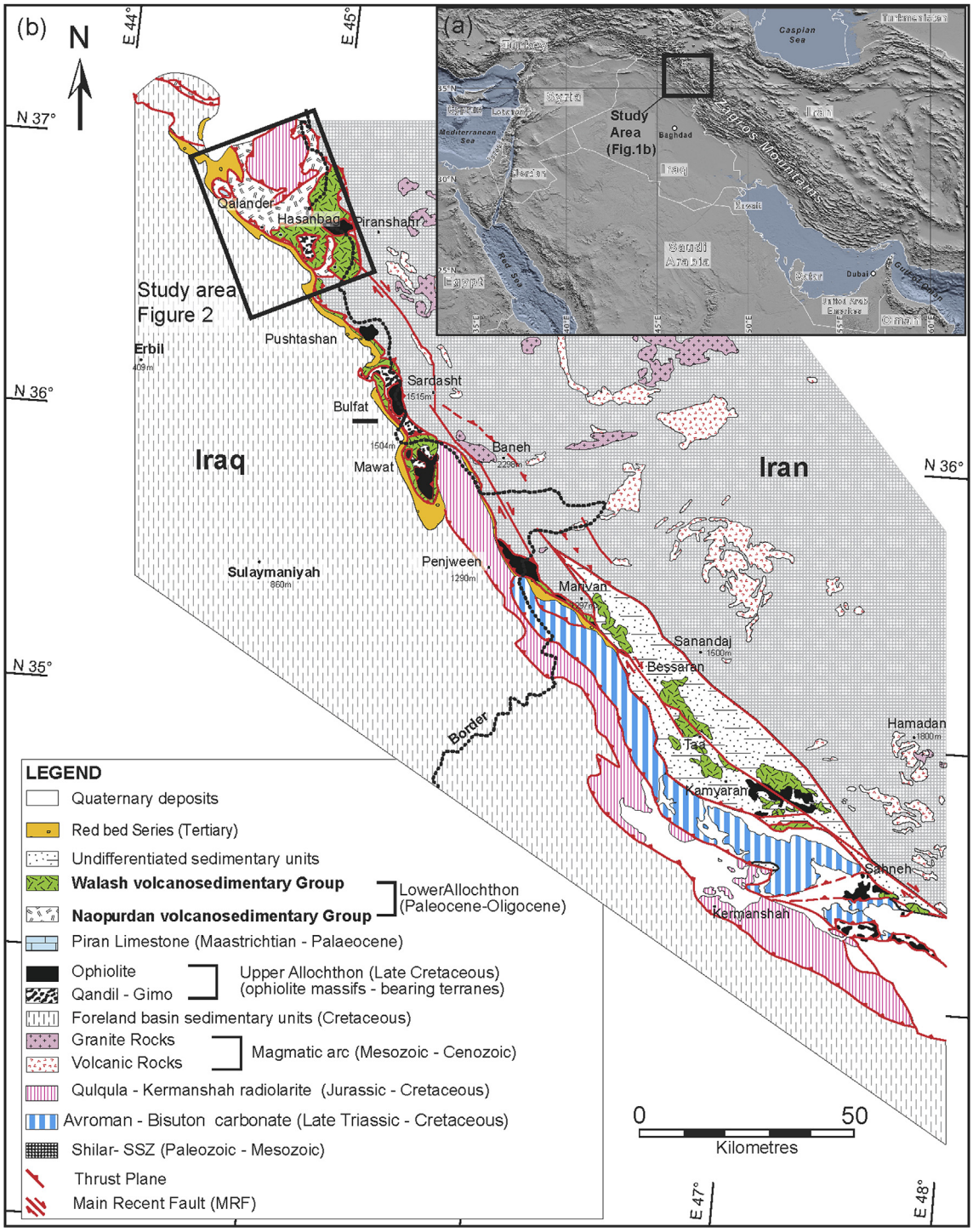

Fig. 1. (A) Location of the study areas within the Zagros Suture Zone (after Ali et al., 2012); (B) Geological map of the Zagros Suture Zone along the Iraq-Iran border showing the location and tectonic subdivision of the study areas (after Ali et al., 2013).