Journal of Asian Earth Sciences 93 (2014) 229–252

Contents lists available at ScienceDirect

Journal of Asian Earth Sciences

journal homepage: www.elsevier.com/locate/jseaes

Geochemistry and petrogenesis of late Ediacaran (605–580 Ma) post-collisional alkaline rocks from the Katherina ring complex, south Sinai, Egypt

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ARTICLE INFO

Article history:
Received 10 February 2014
Received in revised form 8 July 2014
Accepted 21 July 2014
Available online 31 July 2014

Keywords:
Arabian–Nubian Shield
South Sinai
Katherina ring complex
Katherina volcanics
Peralkaline

ABSTRACT

The Katherina ring complex (KRC) in the central part of south Sinai, Egypt, is a typical ring complex of late Neoproterozoic age (605–580 Ma). It was developed during the final tectono-magmatic stage of the north Arabian–Nubian Shield (ANS) during evolution of the Pan-African crust. The KRC includes Katherina volcanics, subvolcanic bodies, ring dykes and Katherina granitic pluton. The Katherina volcanics represent the earliest stage of the KRC, which was subsequently followed by emplacement of the subvolcanic bodies and ring dykes. The Katherina granitic pluton depicts as the latest evolution stage of the KRC that intruded all the early formed rock units in the concerned area. The Katherina volcanics are essentially composed of rhyolites, ignimbrite, volcanic breccia and tuffs. Mineralogically, the peralkaline rhyolites contain sodic amphiboles and aegirine. The rhyolite whole rock chemistry has acmite-normative character. The subvolcanic bodies of the KRC are represented by peralkaline microgranite and porphyritic quartz syenite. The ring dykes are semicircular in shape and consist mainly of quartz syenite, quartz trachyte and trachybasalt rock types. The Katherina subvolcanic rocks, volcanic rocks as well as the ring dykes are alkaline or/and peralkaline in nature. The alkaline granitic pluton forms the inner core of the KRC, including the high mountainous areas of G. Abbas Pasha, G. Bab, G. Katherina and G. Musa. These mountains are made up of alkaline syenogranite and alkali feldspar granite. The mantle signature recorded in the KRC indicates a juvenile ANS crust partial melting process for the generation of this system. The evolution of the KRC rocks is mainly dominated by crystal fractionation and crustal contamination. Mineral geothermometry points to the high temperature character of the KRC, up to 700–1100 °C.

1. Introduction

The basement rocks in south Sinai and northern Eastern Desert of Egypt form the northwestern segment of the Arabian–Nubian Shield (ANS). The Neoproterozoic rocks of the ANS were evolved as a result of the East African Orogen (Stern, 1994; Küster et al., 2008). The ANS is essentially a juvenile crustal tract, formed by protracted accretion of island arc terranes (e.g. Bentor, 1985; Stern, 2002; Jarrar et al., 2003; Stoeser and Frost, 2006) and is bounded to the east and west by older crusts (Whitehouse et al., 1998, 2001; Johnson and Woldehaimanot, 2003). One of the most striking features of the northward segment of the ANS is the abundance of post-collisional calc-alkaline to alkaline plutonic suites and association of the volcano-sedimentary sequences (Beyth et al., 1994; Jarrar et al., 2003; Ali et al., 2009; Be'eri-Shlevin et al., 2009a).

Ring complexes of Neoproterozoic age are abundant in the ANS (e.g. Harris, 1985; Vail, 1989; Katzir et al., 2007a; Moghazi et al., 2011). These ring complexes were emplaced at the last evolution stage of the ANS (610–590 Ma) during transitional period in tectonic style from compressional to extensional regime (Stern et al., 1984; Kröner et al., 1987; Genna et al., 2002; Be'eri-Shlevin et al., 2009a). The occurrence of late Neoproterozoic ring complexes has been documented in the central part of south Sinai Peninsula, Egypt (Eyal and Hezkiyahu, 1980; Goor, 1982) and in the Eastern Desert (El-Ramly and Hussein, 1985; Hassanen, 1997; Ghoneim et al., 1999). They are commonly composed of quartz syenite and alkaline granites and are associated with consanguineous volcanics and dykes. The alkaline ring complexes of Phanerozoic age (435–89 Ma) are also exposed in the Eastern Desert of Egypt

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http://dx.doi.org/10.1016/j.jseaes.2014.07.028
1367-9120/