

# Geochemistry of Precambrian mafic magmatic rocks of the Western Himalaya, India: petrogenetic and tectonic implications

T. Ahmad <sup>a,\*</sup>, P.K. Mukherjee <sup>a</sup>, J.R. Trivedi <sup>b,1</sup>

<sup>a</sup> *Wadia Institute of Himalayan Geology, 33, Gen. Mahadeo Singh Road, P.O. Box 74, Dehra Dun 248 001, India*

<sup>b</sup> *Solar System and Earth Science Division, Physical Research Laboratory, Ahmadabad 380 009, India*

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## Abstract

Precambrian sequences of the Higher Himalayan Crystallines (Vaikrita Group) and the Lesser Himalaya (Chail, Jutogh and Jaunsar Groups), in the Garhwal and Himachal regions of the Western Himalaya, include abundant metamorphosed mafic lavas and dykes (amphibolites). A gabbroic body within the Chail Group has been dated at  $1907 \pm 91$  Ma (initial  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio of  $0.7022 \pm 0.0008$ ) by the whole rock Rb–Sr method. This age is consistent with several age data (1800–2000 Ma: whole rock Rb–Sr method), assigned to the granitoids and gneisses of this region. These amphibolites and gabbros exhibit low-Ti tholeiite characteristics. The Lesser Himalayan samples are enriched in light rare earth elements (LREE) and large ion lithophile element (LILE), with distinct negative Nb, Sr, P and Ti anomalies. Conversely, the Vaikrita Group samples are characterized by less enriched LREE–LILE and absence of the above anomalies but have distinct positive Sr anomalies. The chemical characteristics of the Lesser Himalayan samples are remarkably similar to the basal Aravalli volcanics of the NW Indian shield, inferred to reflect significant components from enriched mantle sources and crustal contamination. Samples of the Vaikrita Group appear to have been influenced by an asthenospheric mantle and are less contaminated as indicated by the absence of negative Nb, P and Ti anomalies. These distinct geochemical characteristics are used to demarcate the Main Central Thrust along the Vaikrita Thrust. The Chail and Jutogh Groups are affiliated with the Lesser Himalaya and the Chail Group gabbro body may represent portion of one among the numerous magma chambers that fed a large Precambrian magmatic province in the south of the Main Central Thrust. The similar emplacement ages (1800–2000 Ma) for the mafic and felsic magmatic rocks, suggest that this region experienced a major episode of crustal generation and evolution in a rift environment. © 1999 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

In the last decade the mafic magmatic rocks of the Lesser Himalayas (Jaunsar Group), particularly from

the Western Himalaya have been subjected to detailed studies (Ahmad and Bhat, 1987; Ahmad and Tarney, 1991; Bhat et al., 1992; Bhat et al., 1994). However, little information is available on the neighboring mafic magmatic rock of the Chail and Jutogh Groups in the Lesser Himalayas and the Vaikrita Group of the Higher Himalayan Crystallines (Fig. 1). The Higher Himalayan Crystallines were emplaced

\* Corresponding author. Tel.: +91-135-620596; fax: +91-135-625212; e-mail: wihg@giasdl01.vsnl.net.in

<sup>1</sup> Fax: +91-079-6560502; e-mail: jtrivedi@prl.ernet.in.