Paper Number: 3150

New constraints from zircon U-Pb ages and Hf isotopic compositions on the late Palaeoproterozoic continental arc granitoids in the Aravalli orogen, NW India

Kaur, P. [1], Zeh, A. [2,3], Chaudhri, N. [1]

[1] Panjab University, CAS in Geology, Chandigarh – 160 014, India; naveen.geol@gmail.com

[2] J.W. Goethe Universität, Institut für Geowissenschafte, D-60438, Frankfurt am Main, Germany

[3] Karlsruher Institut für Technologie, Institut für Angewandte Geowissenschaften, D-76131 Karlsruhe, Germany

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Insights gained regarding the age, origin and petrogenesis of granitoids considerably enhances our understanding of the evolution of continental crust. The conventional whole-rock isotope (Nd-Sr-Hf) data are neither suitable to identify the nature nor the relative contribution of crustal and mantle melts in the sources of granitoids because such data provide information only on the final locally homogenised average of the source rocks involved in the magma genesis. In this context, the *in situ* U-Pb-Hf isotope compositions of zircon have been proven to be effective not only in providing much better resolution in space and time, but also the mineral is known for its resilience to complex post-magmatic secondary processes. The usage of this approach on late Palaeoproterozoic granitoids in northern Aravalli orogen establishes not only a wider extent of continental arc magmatism in NW India, but also place constraints on their crustal origin. The new zircon U-Pb data suggest that the continental arc magmatism in the north-central Aravalli orogen spanned over at least 40 Myr from 1.86-1.81 Ga. The U-Pb ages from zircon overgrowths and monazite grains suggest that these granitoids were metamorphosed at 1.85, 1.65, 1.35, 0.97 and 0.87 Ga. The negative εHf_t and εNd_t values and the corresponding mean Neoarchaean model ages (2.9-2.6 Ga) indicate that the granitoids were essentially derived by melting of Archaean crust. This is further supported by the presence of 2.7-2.5 and 3.3 Ga inherited zircon grains in these rocks. The flat HREE patterns with negative Eu anomalies indicate that the granitoids were generated from garnet-free and plagioclase-rich sources at shallow depths. The differentiation of basaltic magma, which was derived by partial melting of the mantle wedge over the subduction zone, resulted in the generation of hot silica-H_2O-rich residual fluids. The volatiles exsolved from the latter and the LILE-enriched fluids emanated from dehydration of subducting lithosphere, carried subduction-related signatures. These fluids interacted with the Archaean felsic crust to generate the granitoid magmas.

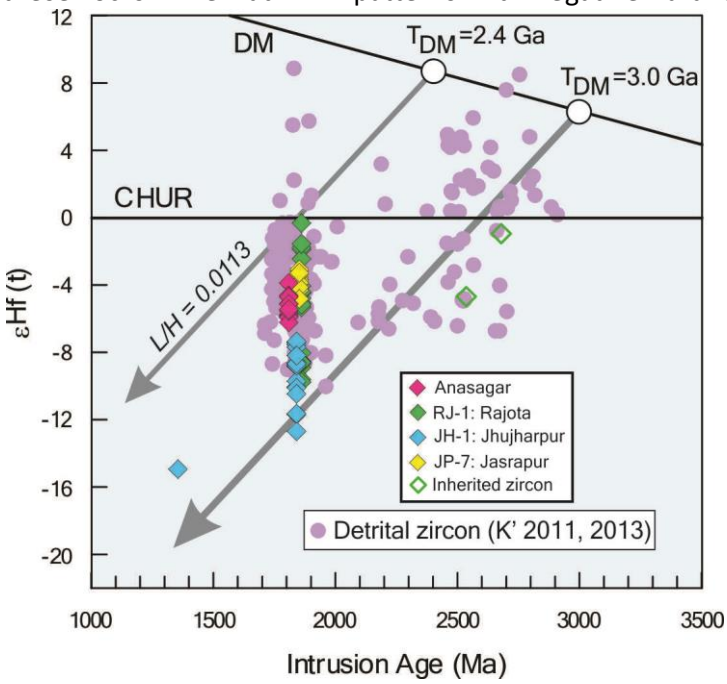

Figure 1: Intrusive age versus εHf(t) diagram showing data of the present studying comparison with detrital zircon data from the Khetri complex. K' 2011 [1] and K' 2013 [2].

References:

[1] Kaur P et al. (2011) Precambrian Res 187: 155-164

[2] Kaur P et al. (2013) Gondwana Res 23: 1040-1052