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\textbf{New geochronological and isotopic constraints for the 1.7 Ga albitised A-type granitoids in NE Rajasthan, India: implications for Palaeoproterozoic crustal evolution of the Aravalli orogen}

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Granitoid plutons of the Khetri complex have been studied for zircon U-Pb and Pb-Pb thermal ionisation mass spectrometry methods along with the whole-rock geochemistry to provide new constraints on the Palaeoproterozoic magmatic activity in the Aravalli orogen of northwestern peninsular India. The rocks are metaluminous to weakly peraluminous, largely ferroan and intraplate A-type granites. All the intrusives, but for one, show evidence of moderate to extreme albitisation forming microcline-albite granite and albite granite, respectively. These granites have been albitised by two metasomatic fronts, an initial transformation of oligoclase to nearly pure albite, and a subsequent replacement by albite, with sharp contacts between the microcline-bearing and microcline–free zones. The mineralogical changes associated with progressive albitisation include transformation of oligoclase ($\sim An_{12}$) and microcline ($\sim Or_{95}$) to almost pure albite ($\sim An_{0.5-2}$), ferropargasite to hastingsite and actinolite, and biotite to magenesio-hornblende/actinolite. Whole-rock mass balance calculations show that, during albitisation, the granites experienced major gain in Na, whereas K, Mg, Fe and Ca were lost along with Rb, Ba, Sr, Zn, LREE and U. At the scale of individual intrusions, the narrow ranges in ε_{Ndi}values (-1.3 to -2.9 and -4.9 to -6.2), $^{147}Sm/^{144}Nd$ ratios (0.1024 to 0.1236 and 0.1359 to 0.1492) and mean crustal residence ages (T_{DM} = 2.28-2.17 Ga and 2.4-2.5 Ga) in moderately albitised rocks show that these parameters were not strongly affected by albitisation whereas the completely albitised granites exhibit relatively high $^{147}Sm/^{144}Nd$ ratios and low apparent ε_{Ndi}values. Severe scatter in the whole-rock Rb-Sr isochron plot reflects the high mobility of both Sr and Rb during albitisation. Extreme Rb loss in the completely albitised samples has effectively frozen $^{87}Sr/^{86}Sr$ ratios in the albite granites at very high values, indicating a considerable time lag (estimated to be at least 300 Ma) between original intrusion and albitisation. The albitisation likely took place at sub-solidus temperatures of $\sim$350 to 400°C. It was caused by the infiltration of an ascending high-$\delta^{18}O$ hydrothermal fluid, which had acquired high Na/K and Na/Ca ratios during migration through metamorphic rocks at even lower temperatures in the periphery of the plutons. The regional comparisons make evident that the northern Aravalli orogen records a widespread event of sodium metasomatism. The confinement of the albitised granites along the NE-SW trending Khetri lineament and the pervasive nature of the albitisation suggest that the albitising fluids possibly originated during the continual reactivation of the lineament. The U-Pb zircon age data for most of the plutons cover a time span of 1732-1682 Ma, while the Pb-Pb zircon evaporation data of some intrusives indicate minimum ages between 1671 and 1537 Ma. Furthermore, a regional survey of late Palaeoproterozoic ages in the Aravalli orogen provide considerable evidence for a geographically widespread ca. 1700 Ma extensional-related event in the northwestern Precambrian Indian shield. The record of comparable ages and magmatic history reported in parts of North America and North China craton indicates the significance of this event in understanding not only the Precambrian evolutionary history of the Aravalli orogen, but also the breakup tectonics of the supercontinent Columbia.