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Dating the India-Eurasia collision through arc magmatic records

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In the Himalaya, despite intensive research, the age of collision between India and Eurasia along the Tsangpo suture is still debated, with estimates ranging from 70 to 35 Ma. In the Western Himalaya, separated from the Eurasian plate (Karakoram) to the north by the Shyok suture, and from the Indian plate to the south by the Indus suture, lies the Kohistan-Ladakh Arc (KLA). This geological entity is recognized as a fully preserved oceanic arc, formed in the Tethys Ocean and now incorporated in the Himalayan collision system. The age collision estimate between the Arc and Eurasia range from Mid-Creataceous to Oligocene, whereas the India-Arc collision ranges from Early Paleocene to Late-Eocene.
The middle to upper crustal part of the KLA is made of plutonic rocks ranging from diorite to granites, together with Volcano-sedimentary units. The crust-forming granitoids records a magmatic activity between >120 and 30 Ma, covering the range of estimated India-Arc and Arc-Eurasia collisions. Here, we present a detailed geochronological and isotopic study of the KLA granitoids in order to: (1) pinpoint the exact timing of the change in isotopic composition relating the arrival of the colliding continent in the subduction zone; and (2) to identify the possible sources accounting for those differences. We present U-Pb and Hf isotopic data on zircon coupled with Nd isotopic data on whole rocks from the KLA granitoids. In the southern part of the KLA, close to the Indus suture, a pronounced and abrupt shift in isotopic composition is observed from typical juvenile oceanic arc isotopic signature (εNd(i) $\approx$ +1; εHf(i) $\approx$ +10) during the Jurassic/Early Paleocene to more evolved but highly variable crustal like composition in the Eocene/Oligocene (-10 < εNd(i) , -4; -15 < εHf(i) < 0). Inherited Paleozoic zircon crystals in the Eocene/Oligocene rocks indicate the participation of the Indian continental crust in their formation thus indicating that the Indian crust was underplated below the juvenile KLA therefore giving a minimum constraint on the India-KLA collision. In the North of the KLA, close to the Shyok suture, the change from juvenile arc signature to a more evolved crustal like isotopic composition occurred 10 Ma later. Inherited zircon grain record identifies the Karakoram crust as being involved in the source of the young granitoids, thus constraining the final India/Arc-Karakoram collision in late Eocene. This collisional scenario can be transposed all along the Himalayan belt, defining the Shyok-Tsangpo suture zone as the locus of the final India-Eurasia collision.