EXHUMATION HISTORY OF THE WESTERN LHASA BLOCK (SW-TIBET)

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Based on field observations and geochronological dating different exhumation paths were determined for the southern and the northern parts of the Lhasa Block for the time following the India-Asia collision.

The continental fragment of the Lhasa block collided with Eurasia in the middle to late Jurassic, forming the Banggong suture zone (DEWEY et al., 1988). During the NNE directed subduction of the Tethys ocean an Andean-type magmatic arc was formed at the southern margin of the Lhasa block. Radiometric data indicate the beginning of this magmatic activity at about 110 Ma and its continuation until about 40 Ma (SCHÄRER et al., 1984). The Linzizong formation encompasses the youngest volcanic rocks of this belt (60–48 Ma, e.g. COULON et al., 1986).

The unroofing history (Fig. 1a) of the batholith in the southern part of the Lhasa Block was determined from sample HF197/93, a hornblende granodiorite from the Transhimalaya Batholith at the base of Mt. Kailas. The data agree well with those of other samples from this area (AN YIN et al 1996) and are similar to those of the Gangdese Batholith in the vicinity of Lhasa (RICHTER et al., 1991; COPELAND et al., 1995). A crystallization age of 107±3 Ma was obtained by the U–Pb method on sphene for the Kailas pluton which was emplaced at a depth corresponding to a pressure of 2.7 kbar as inferred from the composition of igneous amphiboles using the geobarometer of SCHMIDT (1992). The cooling path indicated by Ar–Ar and Rb–Sr mineral data is characterized by slow cooling until 45 Ma, followed by relatively rapid erosion until ca. 27 Ma, when the rock reached the surface. Subsequently, this part of the batholith was again buried beneath at least 1500 m of Kailas molasse sediments. Data on the degree of coalification of plant fossils in the molasse indicate a maximum temperature of 154°C at about 20 Ma.

TE19/93 is a hornblende granodiorite pluton near Xungba (ca. 120 km north of the Indus Tsangpo suture zone) with a different cooling history (Fig 1b). There is no radiometric crystallization age available yet. Field observations, however, indicate an intrusion into the lower Cretaceous sediments of the Takena formation. Hornblende compositions and primary magmatic epidote suggest pressures of c. 6 kbar during crystallization of the plutons in the central Lhasa block. Ar–Ar and Rb–Sr ages of biotite indicate rapid cooling to 300°C at c. 92 Ma. The timing of uplift to the surface is unknown, but must have occurred prior to 25 Ma because volcanic rocks extruded at 17 to 25 Ma rest unconformably on top of the granite.

In the northern Lhasa block uplift and erosion started already in the Cretaceous. In contrast, slow cooling is recorded by the rocks of the southern part until the India-Asia collision at ca. 50 Ma. At that time the shallow marine to continental, coal bearing sediments of the Moincer formation suggest a low altitude.

From about 50 to 27 Ma the cooling history indicates a pronounced unroofing of the southern Lhasa block. The deltaic sediments of the Kailas molasse cover unconformably the top of the granitoids. Unionide bivalves suggest an upper Oligocene/lower Miocene age (ca.23 Ma) and a none-marine environment for this deposit.

From 25 to 17 Ma eruption of ultrapotassic, potassic and shoshonitic volcanic rocks is widespread in the western Lhasa block. These volcanic rocks were extruded over a relatively flat palaoesurface. TURNER et al. (1996) have proposed convective thinning of the lithospheré as the thermal trigger for this post-collision volcanism. This process could also have induced significant uplift of the plateau.

Continuing convergence lead to the activation of the north vergent Kailas thrust system (GANSSER, 1939) at about 13 Ma (AN YIN et al., 1996) juxtaposing a sequence of purple conglomerates and sandstones over the Kailas molasse sediments. The Transhimalaya was then uplifted for more than 1500 m relative to the plateau of the northern Lhasa block and erosion cut down again to the base of the Kailas molasse.

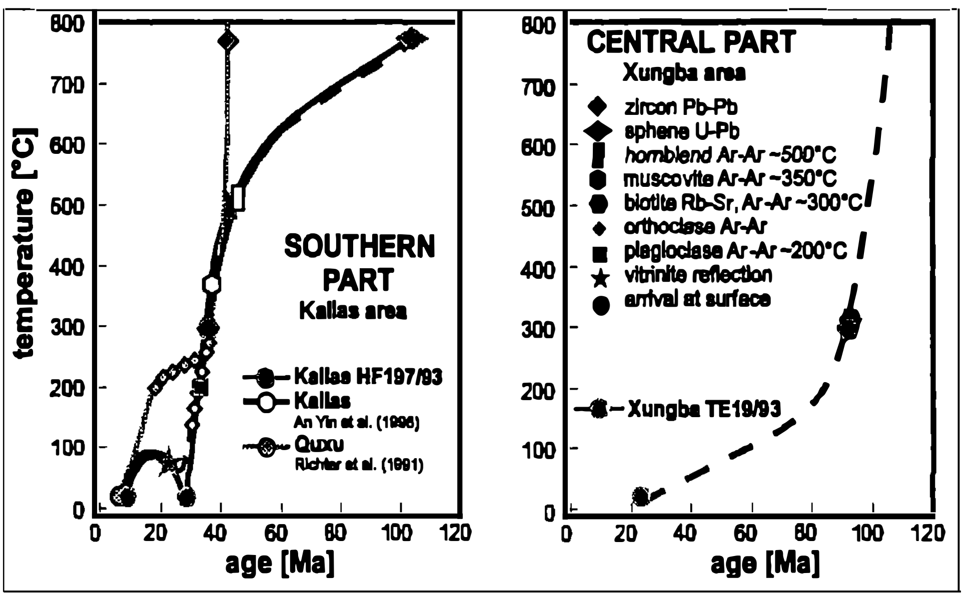

Fig. 1: Cooling paths of plutonic rocks of the southern and central Lhasa block.

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