TIMING OF METAMORPHISM AND EXHUMATION OF THE RED RIVER SHEAR ZONE IN N-VIENTAM.

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The Red River shear zone (RRSZ) has been interpreted as a left-lateral fault absorbing significant amount of post-collisional India-Asia convergence by accommodating extrusion of the Indochina block. The Day Nui Con Voi (DNCV) massif in N-Vietnam defines the southernmost segment of the RRSZ, and is c. 200 km long and up to 20 km wide. DNCV is composed predominantly of migmatitic paragneisses, which recorded $T = 750 - 850^\circ$C at $P = 0.6 - 0.8$ GPa. Structural observations indicate two major deformation phases 1) NW-SE oriented sinistral strike-slip shearing, followed by 2) NE-SW oriented extension (with sub-ordinate strike-slip component). During the second phase a large scale antiformal dome was formed, in the core of which, blocks of ultra-mafites occur. $^{176}\text{Hf}/^{177}\text{Hf}$ and $^{143}\text{Nd}/^{144}\text{Nd}$ ratios point to their origin in the lithospheric mantle, which allows to determine the minimum depth of c. 30 km, riched by the fault. Sm-Nd dating of pre-kinematic garnets from Yen-Binh and Bao-Yen regions gave 40.0±1.0 and 41.3±1.2 Ma respectively. These ages are interpreted as representing cooling from the metamorphic peak and provide maximum age for the beginning of strike-slip shearing. Fission Track dating of Yen Binh sample gave cooling ages of 28.7±2.0 (zircon) and 32.0±3.8 (apatite). The same within error ages and large track length indicate fast cooling. Taking c. 700°C closure temperature for garnet and c. 100°C for apatites, estimated cooling rate of 60°C/Ma is estimated. Slower cooling was obtained for the Bao Yen area, where apatite FT dates yielded 21.0±1.0 Ma. Further north, in the Laocai area, zircons gave 30.4±2.1 and apatites 25.0±1.0 Ma ages. Younger apatite FT ages in the northern part in comparison with the southern area (Yen Binh) is probably due to influence of the younger uplift of the neighboring
Song Chay massif, where previous apatite FT dating gave c.19–24 Ma dates. Therefore cooling rates obtained for the northern part of the massif will be underestimated.

Our geochronological results place tight time constraints on the main period of RRSZ activity, comprising both, strike-slip movement and a major extensional phase. Within about 10 Ma the Red River shear zone was uplifted and exhumed from the depth of c. 20 to 30 km. This translates into minimum uplift rate of 2–3 mm/yr, which we interpret as due to vertical extrusion of the DNCV massif during extensional phase.