Preliminary Fission Track Ages from the Swat Valley, Northern Pakistan

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A number of the lithologies found in the Swat Valley have been dated by the fission track method to assess and to describe the area's uplift history (Figure 1).

The Swat Valley, located in northern Pakistan, is crossed by a major tectonic boundary, the Patan fault of Desio (1979) or the Main Mantle Thrust (MMT) of Tahirkheli *et al.*, (1979). Associated with serpentinites and blueschists (true glaucophane-lawsonite facies), this fault separates high grade metasedimentary rocks, granites and granite gneisses in the south from the Kohistan Basic Complex to the north. The latter group of rocks includes amphibolites and pyroxene granulites (Jan, 1979), and is interpreted by Tahirkheli *et al.*, (1979) as the lower part of a remnant island arc trapped between the converging Indian and Eurasian plates in the Paleogene.

Fission track ages determined using the minerals sphene, zircon and apatite reflect the time of cooling of the rock sampled through a temperature unique to each mineral. The track retention temperatures appropriate to sphene, zircon and apatite under the conditions of cooling found in Swat (uplift of a high-grade metamorphic and igneous terrane) are about 250°C, 175°C, and 100°C, respectively (Naeser, 1979).

The ages shown in Figure 1 are almost certainly uplift ages. Pb/U determinations made on three zircon splits obtained from the pyroxene granulite located to the north of the MMT fall nearly on Concordia at about 84 m.y. Zircons obtained from a metasediment located south of the fault give a fission track age of about 22 m.y., the same as zircons obtained from associated granites and gneisses. Thus it can be shown that the fission track ages of rocks located north of the MMT are not intrusive ages, and similarly that ages of rocks located south of the MMT must be yielding uplift ages.

We draw two conclusions from these fission track ages. First, marked discordance in sphene and zircon ages across the MMT indicate that the fault divides two regions of greatly differing uplift history (Figure 2). Second, the nearly uniform apatite ages across the fault imply in turn nearly uniform uplift of the entire Swat Valley area at about 15 m.y.b.p. This uniform uplift apparently has continued to the present, as the MMT does not separate regions of differing relief, nor is the fault trace evident on LANDSAT imagery.

With the present data, the nature of the differential uplift prior to 15 m.y. (older cooling ages on the presumed upper plate of the thrust) is difficult to explain. An adequate interpretation must await further results from both the Swat Valley and along strike. Similarly, an adequate interpretation of the Pb/U data awaits further dates on the pyroxene granulites at a number of different sites.

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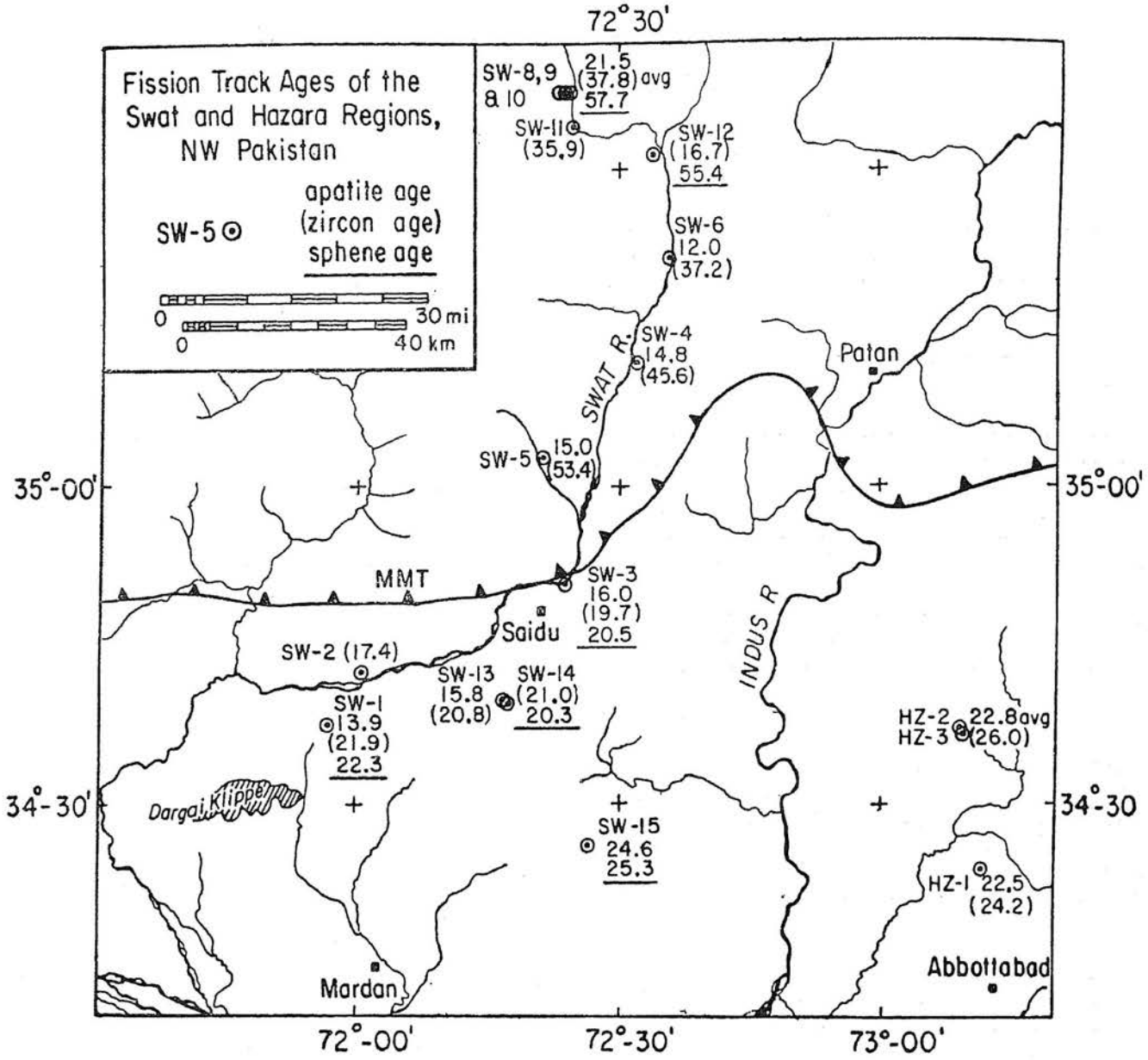

Fig. 1. Location of samples with dates.

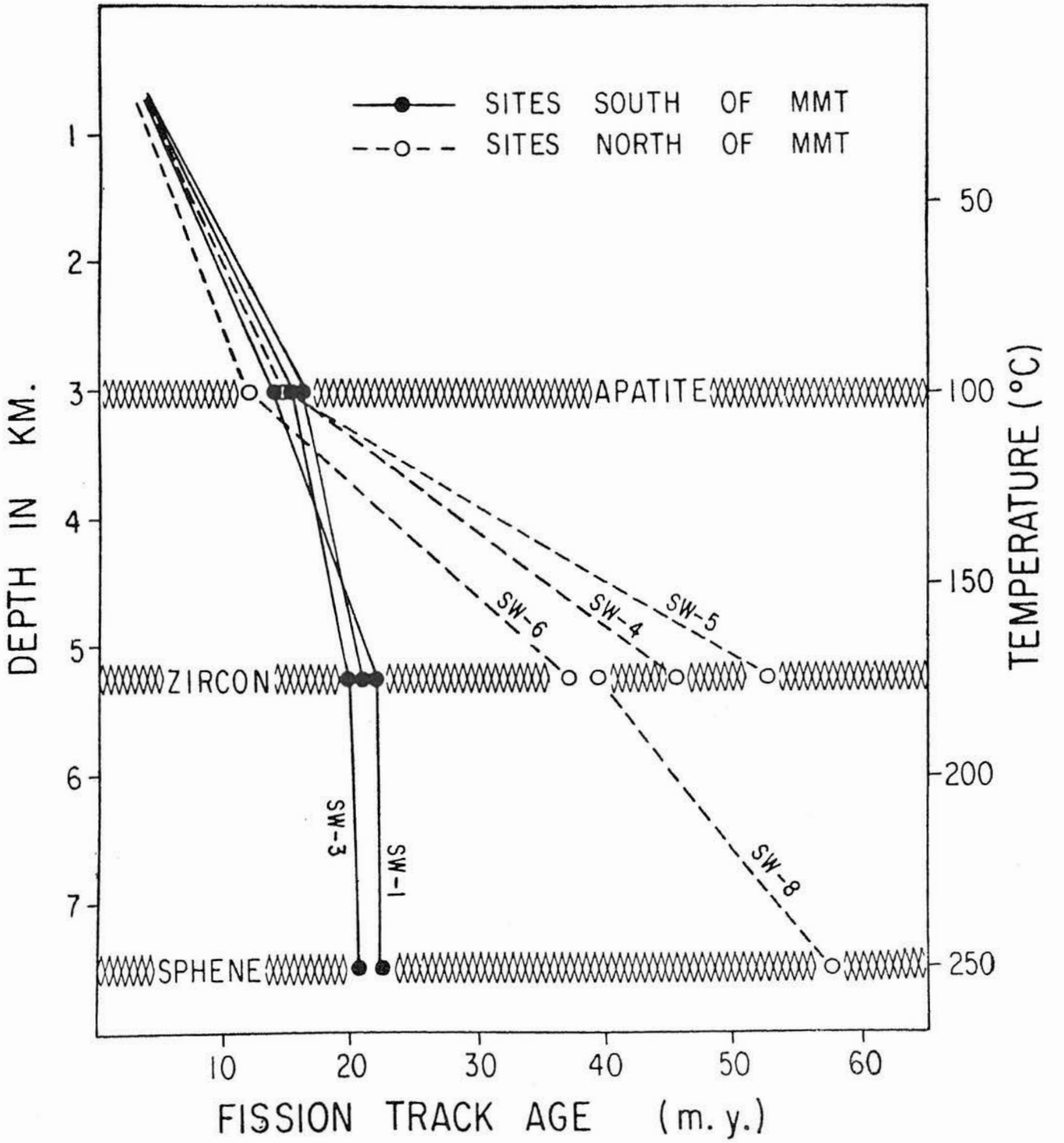

Fig. 2 Uplift-erosion history of selected rocks, Swat Valley.