ESTIMATING THE AGE OF THE FLAT SLAB BENEATH THE CENTRAL ANDES

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The age of subduction is estimated for some portions of the slab beneath the Central Andes. Hypothetical, trench to foreland trajectories on the Earth surface of particles of the Nazca plate were calculated at selected latitudes. This was achieved by combining Nazca-South America relative motions and convergence between the trench and the craton due to horizontal shortening in the eastern deforming belt of the Central Andes. Transferring these superficial trajectories on the Wadati-Benioff zone shows the current position (latitude, longitude, and depth) of particles of oceanic lithosphere which entered in subduction at 10, 7.5, 5, and 2.5 Ma (Fig. 1 and 2). Application of this exercise assumes that: 1) the slab is physically continuos; 2) the area of the oceanic lithosphere is conserved after subduction; 3) the relative position of the trench respect to the foreland has not been significantly modified by tectonic erosion during the last 10 m.y.; and 4) the azimuth of the slab motion with respect to a fixed South America is the same as that of the Nazca plate. The position of particles entering the subduction zone at 10 Ma are not well constrained because they lye in a zone where the depth of the slab is not well defined.

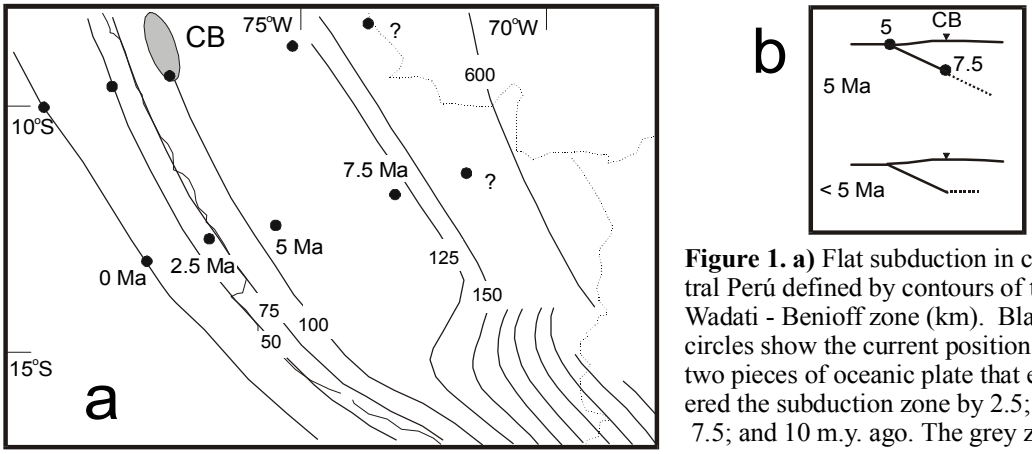

Figure 1. a) Flat subduction in central Perú defined by contours of the Wadati - Benioff zone (km). Black circles show the current position of two pieces of oceanic plate that entered the subduction zone by 2.5; 5; 7.5; and 10 m.y. ago. The grey zone shows the location of the Cordillera Blanca (CB). **b)** A cross-section drawn perpendicular the trench axis shows the position of the magmatic arc. Model results suggest that the oceanic lithosphere entering the subduction zone 7.5 m.y. ago was likely beneath the CB (depth of ~ 100 km) about 5 m.y. ago. Further sinking of that piece of slab during the last 5 m.y. would have been lower than 25 km (Fig. 1a).

The current vertical level of particles entering the central Andean subduction zone 7.5 m.y. ago is about 100 km shallower in the zones of flat subduction (Fig. 1 and 2). The preferred age for the slab inflexion defining flat subduction beneath Perú is around 5 Ma, and possibly a similar age could be adopted for the flat slab in Chile.

The most important intrusive phase in the Cordillera Blanca batholith (CB in Fig. 1a) occurred between 5 and 6 Ma (Petford et al., 1996). The last record of magmatic activity in this zone are volcanic rocks dated between 2.7 and 3 Ma (Petford and Atherton, 1992). Petford et al. (1996) suggested that the source of CB magmas was newly underplated mantle-derived material. The reconstructions suggest that particles entering the subduction zone 7.5 m.y. ago were located beneath the current position of CB by 5 m.y. ago (Fig. 1b). The occurrence of CB suggests the presence of a well-developed asthenospheric wedge by those times, allowing the speculation that the slab was at a depth ~100 km beneath the 5 Ma magmatic arc in this area (Fig. 1b). The current depth of that portion of slab is shallower than 125 km (Fig. 1a), suggesting very low additional sinking (< 25 km) during the last 5 m.y., which may be interpreted as the development of the slab inflexion in Perú central. This suggests that the most recent (younger than 5 Ma) magmatic activity in the area would have been associated with a progressively thinner asthenospheric wedge.

Figure 2 shows the calculated position of particles that entered in subduction in the southern central Andes. Because of poorly constrained crustal shortening data for the southern Puna, the southern points in Figure 2 represent particles entering the subduction zone at different latitudes (30 and 32ºS, see caption). Differential sinking of about 100 km is observed for the particles that entered in subduction 7.5 m.y. ago. On the other hand, the "slab isochron" defined by the 7.5 Ma particles is discordant with the depth contours of the Benioff zone, suggesting that the strike of these later south of 22ºS does not represent the strike of the late Miocene continental margin.

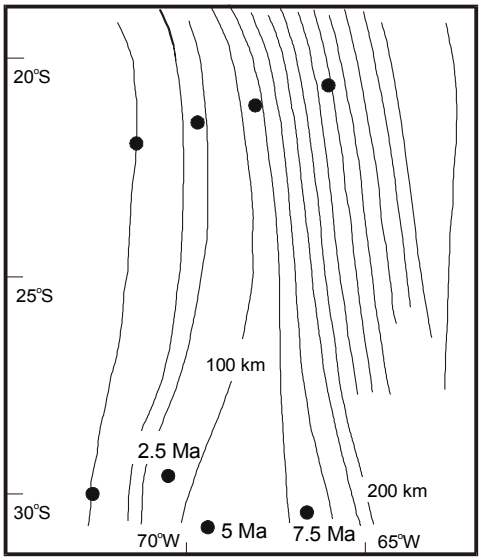

Figure 2. Contours of the Wadati-Benioff zone beneath the southern Central Andes. The southern 2.5 Ma point corresponds to a particle entering the subduction zone at 30ºS, whereas the corresponding 5 and 7.5 Ma points were subducted at 32º S. Oceanic lithosphere entering the subduction zone 7.5 m.y. ago is currently about 100 shallower in the region of flat subduction in central Chile. The pattern suggests that "subduction isochrons" created by the points are discordant respect to the contours of the W-B zone.

REFERENCES

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