

SEISMICALLY ACTIVE FRACTURE ZONES IN THE CONTINENTAL WEDGE OF THE CENTRAL PART OF ANDEAN SOUTH AMERICA

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Detailed studies of the geometry of distribution of earthquake foci revealed that the process of subduction is generally accompanied by a relatively high seismicity in the overlying continental wedge (Hanuš and Vaněk 1977-78, 1979, 1983, 1984a,b, 1987, 1992; Hanuš et al. 1987; Vaněk and Hanuš 1988). In the regions where the oceanic lithosphere is underthrust below the continental plate about one third of earthquakes is located in the continental wedge. It appears that practically all these earthquakes are not distributed randomly showing a clear tendency to accumulate in well-separated linear zones. These zones can be interpreted as a system of deep seismically active fractures induced or activated in the overlying plate by the process of subduction.

The aim of the present work is to differentiate the earthquake foci situated in the continental wedge from those localized in the Wadati-Benioff zone, to attribute the individual earthquake foci to pertinent seismically active fracture zones and to delineate the seismotectonic pattern of the western margin of the South America plate between the parallels 22-35°S.

For the delineation of seismically active fracture zones the International Seismological Centre (ISC) data for the period 1964-92 were used. All hypocentral determinations with lower accuracy, characterized by errors greater than 0.2° in epicentral coordinates, and determinations based entirely on observations of local stations ($\Delta < 20^\circ$) were rejected. The orientation of several fracture zones was confirmed by fault plane solutions from the list of Harvard centroid moment tensor solutions.

In the rectangle limited by parallels 22-35°S and meridians 63-72°W thirteen seismically active fracture zones were delineated. Their pattern is given in Fig. 1. On the basis of their orientation in relation to the Peru-Chile trench they can be divided into the following three groups:

1/ Fracture zones roughly parallel to the trench [a] inclined in the same direction as the subduction zone (Z2, Z6), [b] inclined against the subduction zone (Z3), or [c] vertical or very steeply inclined fractures (Z1, Z4a,b, Z10a,b, Z11). The steeply inclined zones seem to represent the activated older pre-subduction tectonic features.

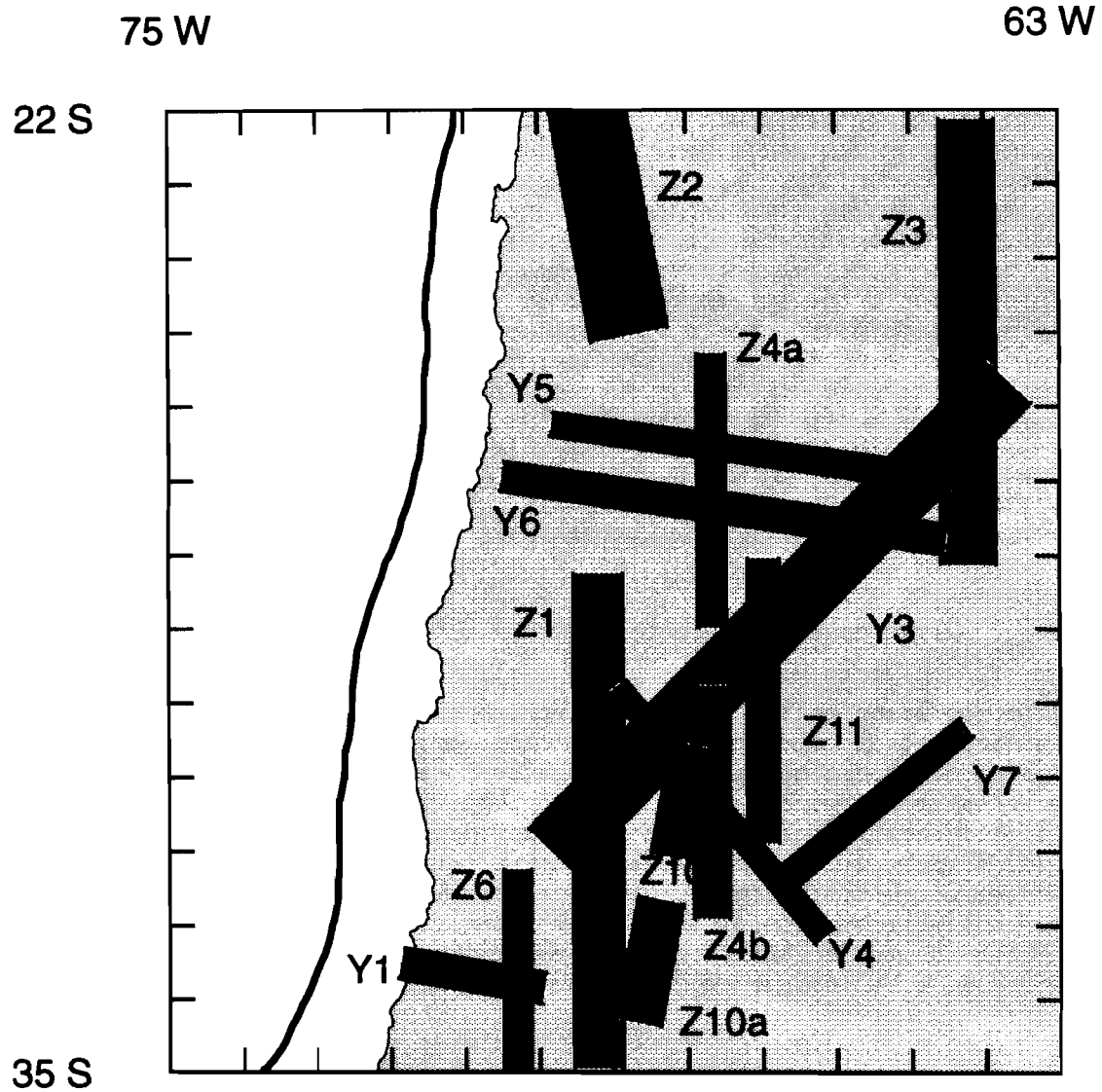


Fig. 1 Pattern of seismically active fracture zones in the continental wedge. The axis of the Peru-Chile trench is denoted by a heavy line.

2/ Fracture zones roughly perpendicular to the Peru-Chile trench (Y1, Y5, Y6). They represent the continuation of transform faults in the subducted oceanic plate into the overlying continental wedge. These fracture zones are vertical or steeply inclined and portray the boundaries of individual segments of the subduction zone. They are independent on the internal structure of the continental wedge.

3/ Fracture zones oblique to the Peru-Chile trench (Y3, Y4, Y7), which are oriented under an angle of about 45° in relation to the direction of the recent Andean subduction.

The individual seismically active fracture zones can be geometrically well documented and found in vertical sections perpendicular to the trench axis, as shown by selected examples in Fig. 2.

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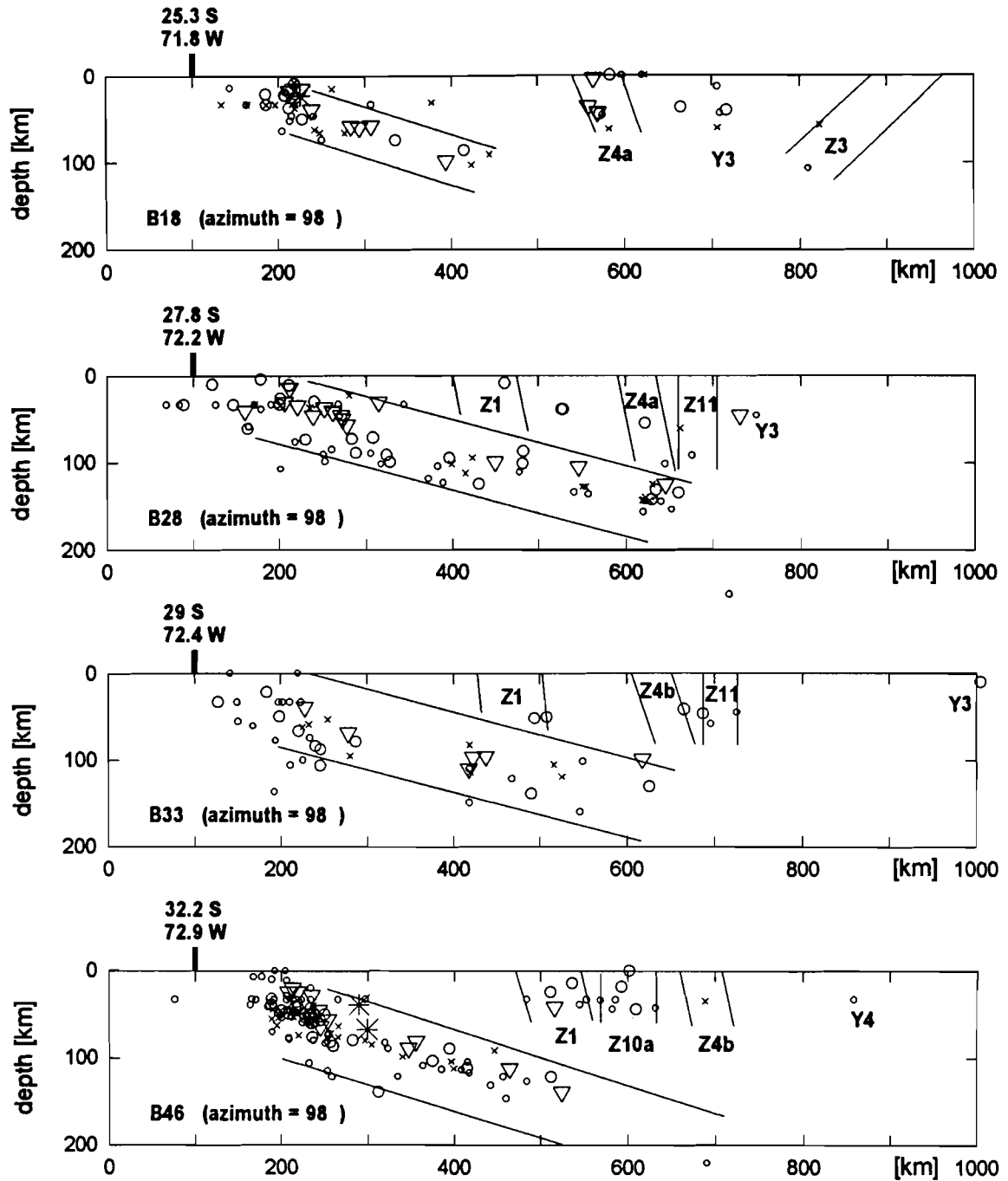


Fig. 2 Vertical sections perpendicular to the trench giving the depth distribution of earthquake foci; width of sections 25 km, ISC foci are denoted with different symbols according to ISC magnitude, Wadati-Benioff zone by heavy parallel lines, individual fracture zones are labelled as in Fig. 1.