THE "WEST FISSURE" AND THE PRECORDILLERAN FAULT SYSTEM OF NORTHERN CHILE

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RESUMEN

La Falla Oeste, o West Fissure, de la mina de cobre de Chuquicamata muestra en sus rocas de falla estructuras de desplazamiento transcurrente sinistral N-S. Lo cual es opuesto a los desplazamientos dextrales comprobados en otras fallas N-S de la Precordillera del Norte Chileno. De esta forma existen evidencias de una inversión de los movimientos transcurrentes en el Oligoceno.

KEY WORDS: Magmatic arc, strike-slip faults, porphyry copper deposits, tectonic inversion

INTRODUCTION

The Chilean Precordillera, situated between the Longitudinal Valley and the Western Cordillera of northern Chile, was the site of the Andean magmatic arc from the late Cretaceous to the early Oligocene. During the Late Eocene Incaic Phase, the basement with its sedimentary and volcanic cover was folded to elongate, mostly N-S-trending anticlines, and dextral strike-slip faults developed parallel or at low angles to the fold structures (Reutter et al. 1991: Precordilleran Fault System). Orogen-normal shortening and dextral orogen-parallel strike-slip movements are considered as magmatic arc tectonics under the influence of oblique subduction (Scheuber and Reutter 1992). The Precordilleran Fault System is related to the development of the great porphyry copper deposits of that region. The West Fissure which is an essential branch of the Precordilleran Fault System runs, in N-S direction, through the Chuquicamata open pit (68°54' W; 22°16' S). A detailed study of this main fault and other accompanying faults in Chuquicamata and its surroundings (Fig. 1) shows that the

GEOLOGICAL SETTING

The exposures of the open pit of Chuquicamata (1.8 km E-W, >4 km N-S) exhibit an abundance of vertical faults belonging to different directional groups. More than 90% of the striae developed on the fault surfaces are horizontal, thus showing that wrench tectonics determined the kinematics. The West Fissure is the most important fault of the Chuquicamata mine, as it separates a western non mineralized granodiorite of ~36 Ma from the mineralized eastern block consisting of Paleozoic granite intruded by porphyries of 32-30 Ma and their alteration products (Maksaev et al. 1988, Maksaev 1990). It can be traced as a continuous structure >100 km to the N and about 20 km to the S. A black argillitic fault gouge up to 2,5 m thick demonstrates that this fault absorbed the maximum of the tectonic energy. Evidently, the throw along the West Fissure is younger than the mineralization and, therefore, it is discussed whether the original westward extension of the mineralization was displaced to the N by dextral slip or to the S by sinistral slip.

As structures indicating dextral slip are frequent in the Precordillera (Reutter et al. 1991), the same sense of displacement was assumed for the West Fissure. The fault pattern of Chuquicamata (Fig. 1) shows several faults entering the the West Fissure from the left at

These last two faults, however, display not only structures due to sinistral horizontal shear, but also others formed by dextral shear. This is especially true for the Mesabi Fault to the N

Oligocene (Pardo-Casas and Molnar 1987) which may have allowed relaxation. The sinistral shear stress at this time is not in accordance with the convergence obliqueness deduced by these authors. It may have been generated by a clockwise rotation of the southern Central Andes, as proposed by Armijo and Thiele (1990) for sinstral shear along the Atacama Fault of the Coastal Cordillera during the Quaternary.

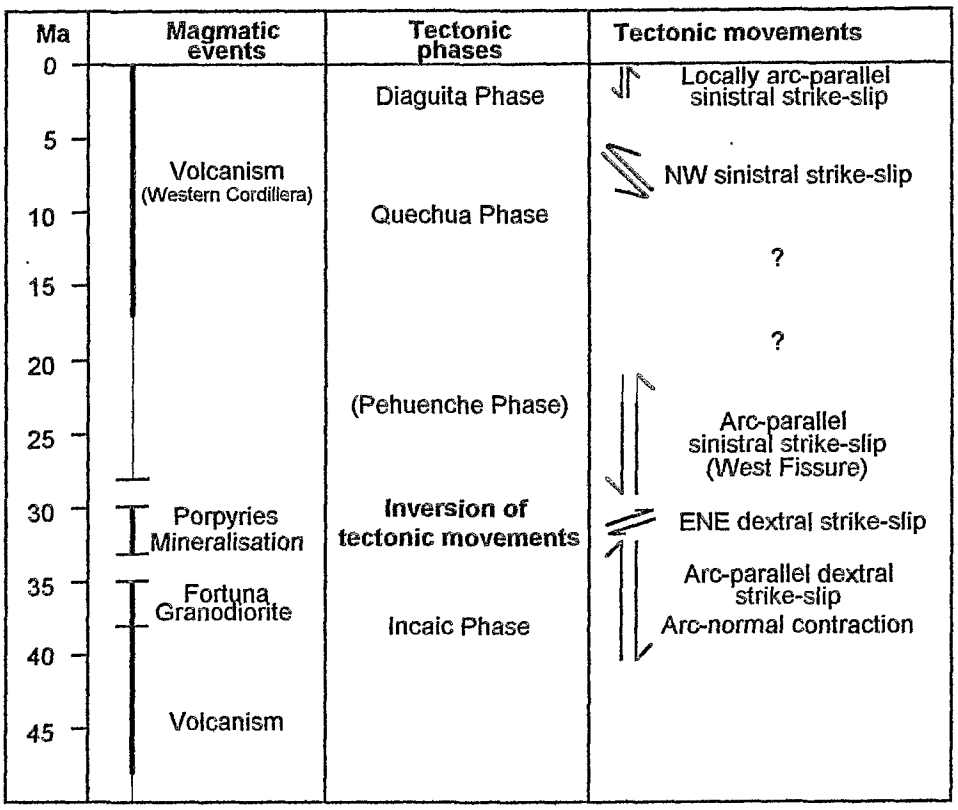

Fig. 2: Sketch of the tectonic development of the Chilean Precordillera near Chuquicamata.

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