STRUCTURAL CHARACTERISTICS OF THE INCAPUQUIO FAULT SYSTEM, SOUTHERN PERU

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INTRODUCTION

The Pacific piedmont of the Cordillera Occidental of southern Peru is characterised by a N125E-trending senestral transcurrent system that is at least 400 km-long and locally >10 km-wide. This contribution describes this structural system in southernmost Peru, where it is known as the Incapuquio-Challaviento fault system (Tacna department, 69°50'-70°45'W; Wilson and García, 1962) or as the Incapuquio, Micalaco and Capillune faults (Moquegua department, 70°45'-71°20'W; Bellido, 1979). In order to simplify this structural nomenclature, we use here the simpler denomination "Incapuquio fault system" (SFI in Spanish).

STRUCTURE OF THE INCAPUQUIO FAULT SYSTEM

Although it presents significant variations along strike, the Incapuquio system (SFI; Fig. 1) is characterised by a number of transpressional characteristics, including positive flower-structures. Although a rhomboidal core of Precambrian and Paleozoic rocks occur in one part of its axial strip, rocks cropping out along the SFI are mainly thick Jurassic volcano-sedimentary marine strata in the SE (Yura Group; Wilson y García, 1962; Vicente, 1989), and thick Late Cretaceous-Early Paleogene igneous and subordinate sedimentary rocks in the NW (Toquepala Group and related intrusions). The SFI was the NE active boundary of the basin in which the Oligocene Moquegua Group accumulated. Sharp and usually angular unconformities separate the deformed Moquegua, Toquepala, and Yura groups, but contacts between these units are locally tectonic. Stratigraphic and structural variations occur across the SFI.

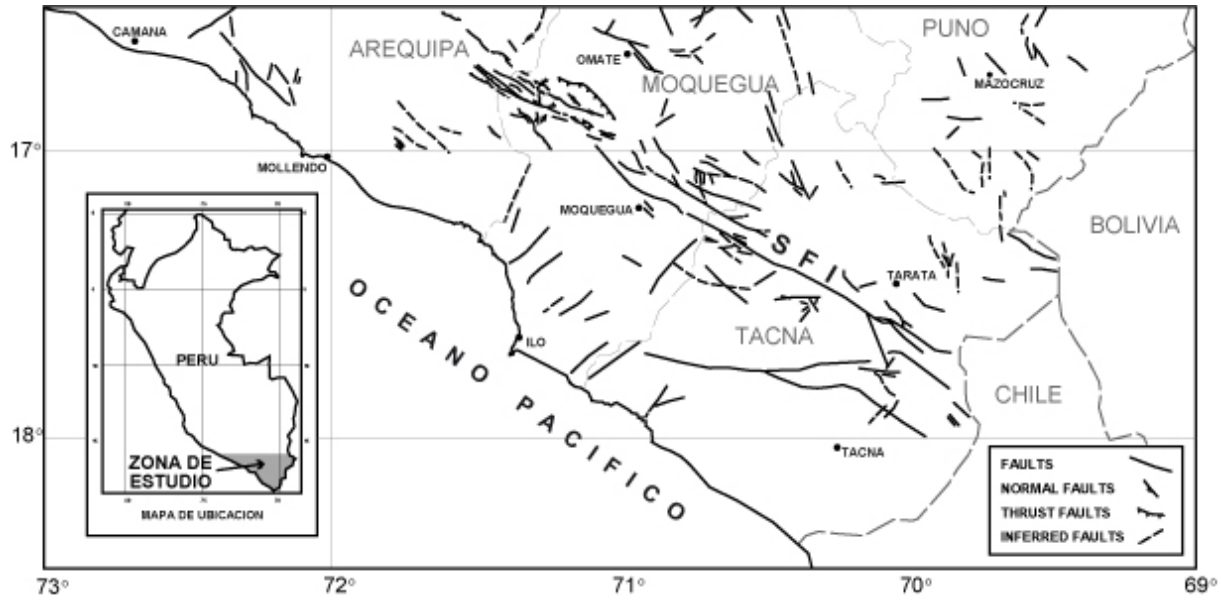

Fig. 1: The tectonic sketch map of southern Peru is dominated by the prominent Incapuquio fault system (SFI).

A variety of observations indicates or is in agreement with the fact that senestral transcurrent motions have occurred along the SFI. Its area of influence include *en échelon* faults and anticlines, subparallel sinuous and anastomosed faults and fractures, asymmetric flower-structures, as well as folds with subvertical axes. The Mal Paso flower-structure (Fig. 1) has exhumed Precambrian basement and overlying Paleozoic strata and is fringed by subvertical mylonite bands. This asymmetric structural "rhomb" presently reaches >4000 m altitude. In the eastern area of the structure, Jurassic strata are intensely faulted and complexly folded, especially near the corners of the "rhomb".

A variety of fault rock fabrics are observed. In the Moquegua area, fault rocks related to the SFI display cataclastic to mylonitic textures and subvertical dips. East of 70°10'W, gouge facies grade into subvertical mylonites that locally reach ultramylonite and possibly pseudotachylite facies farther east. Gouge-mylonite zones may be 100 m to 3 km - wide.

At least near Cuajone and Mirave, the SW fringe of the SFI includes a few SW-verging reverse faults, with dips as low as 35°, that place thick, massive lavas of the Toquepala Group onto thick conglomerates of the lower Moquegua Group. The distribution and thickness of these conglomerates show that the SFI was the active NE boundary of the Oligocene Moquegua basin.

Late Cretaceous-Early Paleogene dioritic, granodioritic, and monzonitic intrusions, locally ore-bearing, are associated with the SFI (Concha y Valle, 1999) and coeval with the thick and dominantly volcanic Toquepala Group. As magma ascension was probably favored by a contemporaneous transcurrent regime of the SFI crustal shear zone, it is likely that the latter was already active in the Late Cretaceous-Early Paleogene. Following Saint-Blanquat et al.'s (1998) model, coeval transpression along the SFI would provide a tectonic framework compatible with the abundant magmatism represented by the Toquepala Group.

CONCLUSIONS

On the whole, the structural characteristics observed along the Incapuquio fault system (SFI) indicate that it is a dominantly transcurrent system, and that it functioned principally in transpression. This transpression possibly represents a Late Cretaceous and/or Cenozoic inversion of a specific part of the Jurassic basin (which had developed by lithospheric thinning; Sempere et al., 2002a&b).

The SFI probably facilitated the Late Cretaceous-Early Paleogene abundant magmatism (Toquepala Group), and remained active during the Oligocene, forming the NE active border of the Moquegua basin. The SFI is currently still seismically active.

The SFI prolongates to the NW (Arequipa department) with some similar characteristics. At 71°45'W, it splits into two main branches that bound the large Huatiapa flower-structure (most probably a compressional jog that inverted a particularly weak area of the Jurassic basin). The SW branch, the El Castillo fault system, represents the true prolongation of the SFI because, as the latter, it shows a SW-verging reverse component. The NE branch has long been described as the Cincha-Lluta fault system (Vargas, 1970; Vicente, 1979) and shows a NE-verging component. Between these fault sytems, the Huatiapa flower-structure mostly consists of Precambrian rocks and Jurassic, Late Cretaceous, and Early Paleogene intrusions. Because it continues northwest at least as far as 72°30'W, we propose the denomination "Incapuquio-El Castillo fault system" (SFIEC in Spanish) to unify the entire system, restraining the name Incapuquio (SFI) for its southern segment.

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