

The Cordillera Blanca fault system as structural control of the Jurassic-Cretaceous basin in central-northern Peru

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KEYWORDS : Cordillera Blanca fault system, Jurassic-Cretaceous basin, central-northern Peru

Introduction

Many works related to the Cordillera Blanca fault system exist (e.g. Bonnot, 1984; McNulty and Farber, 2002). These studies were mainly in the central part of the Cordillera Blanca fault, between northern Yungay and southern Recuay, without taking account the northern outcrops in the Pallasca zone and to the south the Cajatambo zone. The present study presents a new interpretation of the Cordillera Blanca fault system, based on stratigraphic and structural observations of the Jurassic-Cretaceous Chicama-Goyllarisquizga basin in central-northern Peru between Pallasca-Huaraz-Cajatambo, which form part the Cordillera Blanca fault system (CBFS).

Structure and stratigraphy of the Chicama-Goyllarisquizga basin

The termed deposits Chicama Group (Middle-Upper Jurassic) and Goyllarisquizga Group (Berriasian-Aptian), define the termed Jurassic-Cretaceous Chicama-Goyllarisquizga basin in central and southern Peru. This basin is part of the Western Cordillera and to be more precise corresponds to the Cordillera Negra and Blanca. In the north the basin surrounds the Pallasca, Corongo and Huaylas areas, central the Huaraz, Recuay and Aija areas, and south the Cajatambo, Oyon and Churín areas. The basin basement has not been possible determinate. However, in the Aija and Churín area, along the anticline core has been observed ignimbrites intercalated with volcanic breccias, probably corresponding to the Oyotun Formation of Lower Jurassic age.

In the central-northern Peru (8° 30' a 10° 30'), we divided the zone in three stratigraphic basins (Figure 1): The Cretaceous volcano-sedimentary Casma basin (KVSCB), the Jurassic-Cretaceous Chicama-Goyllarisquizga basin, and the Permian-Triassic Mitu-Pucara basin.

The Jurassic-Cretaceous Chicama-Goyllarisquizga basin to the west is limited with the volcano-sedimentary basin by the Tapacocha fault system and to the east is limited with the Permian-Triassic Mitu-Pucara basin by the Chonta fault systems.

The Jurassic-Cretaceous Chicama-Goyllarisquizga basin is characterized by ignimbrites and volcanic breccias of the Oyotun Formation (Lower Jurassic), sandstone sequences intercalated with mudstone to the top and bottom of the Chicama Formation (Middle Upper Jurassic). Those follow by the deposits of the Goyllarisquizga Group (Berriasian-Aptian) characterized by sandstones intercalated with mudstones and limestones, changing to quartz rich sandstones of the Chimú Formation, limestones with mudstones of the Santa Formation, developing to quartz rich sandstones, grauwacas intercalated with gray-red-green mudstones of the Carhuaz Formation, ending in white quartz rich sandstones of the Farrat Formation. Finally, we observe the carbonate sequence (Albian-Campanian) characterize by the Parihuanca, Chúlec, Pariatambo, Jumasha and Celendín units.

The Cretaceous volcano-sedimentary Casma basin is localized to the west of the study area and the boundary with the Chicama-Goyllarisquizga basin correspond to the Tapacocha fault. This basin is characterized by mudstones intercalated with chert, ignimbrites and limestones of the Cochapunta Formation (Albian-Cenomanian).

The Permian-Triassic Mitu-Pucara basin is limited to the west with the Chicama-Goyllarisquizga basin by the Chonta fault. In this basin the Paleozoic-Precámbric basement overlap with unconformity the sandstones and conglomerates, red mudstones intercalation of Mitu Group (Upper Permian-Middle Triassic), limestones of Pucara Group (Upper Triassic-Lower Jurassic) on the top of this deposits and with erosional angular unconformity are the red mudstones and sandstones intercalations that developed from white quartz rich sandstones to conglomerates of the Goyllarisquizga Formation (Berrisian-Aptian?) and to the end we observe limestones sequences of the Chulec-Pariatambo Formation (Albian).

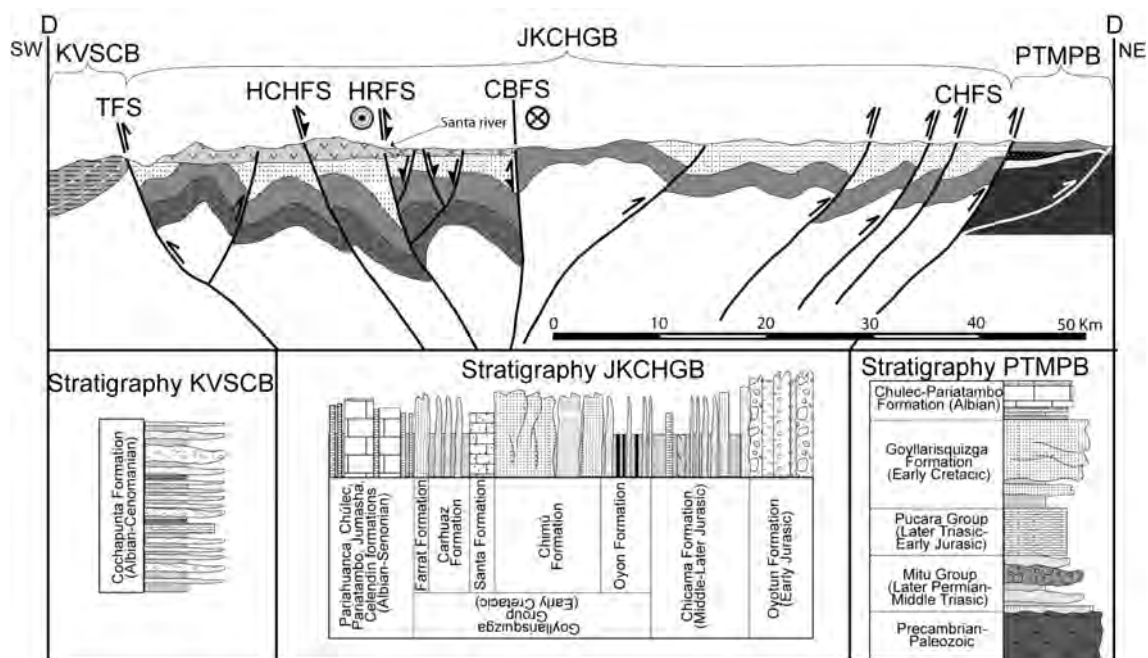


Figure 1. Structural section D-D', showing the three Stratigraphic basins.

Structural controls of the Jurassic-Cretaceous Chicama-Goyllarisquizga basin.

This basin is limited to the west by three reverse fault systems with vergence to west: 1) Tapacocha, 2) Huacllan-Churín, and 3) Huaraz-Recuay faults systems; and to east is limited by two reverse fault systems with vergence to east: 1) Cordillera Blanca and Chonta fault systems. We will now describe the structural sections that cross the Cordillera Blanca fault system.

The section A-A' is located to the northern, has E to W direction, between Cabana and Pallasca towns. We observe the Huaraz-Recuay reverse fault systems with west dip, outcropping the Goyllarisquizga Group rocks and overlying the Tablacacha sequence (Upper Cretaceous-Paleocene, Navarro *et al.*, in preparation). The sediment deformation of the Tablacacha sequence corresponds to folds with west dip. In this area the fold has NE-SW direction and the Huaraz Recuay fault system has NNE-SSO direction, thus indicate a reverse sinistral motion for the Huaraz Recuay fault system.

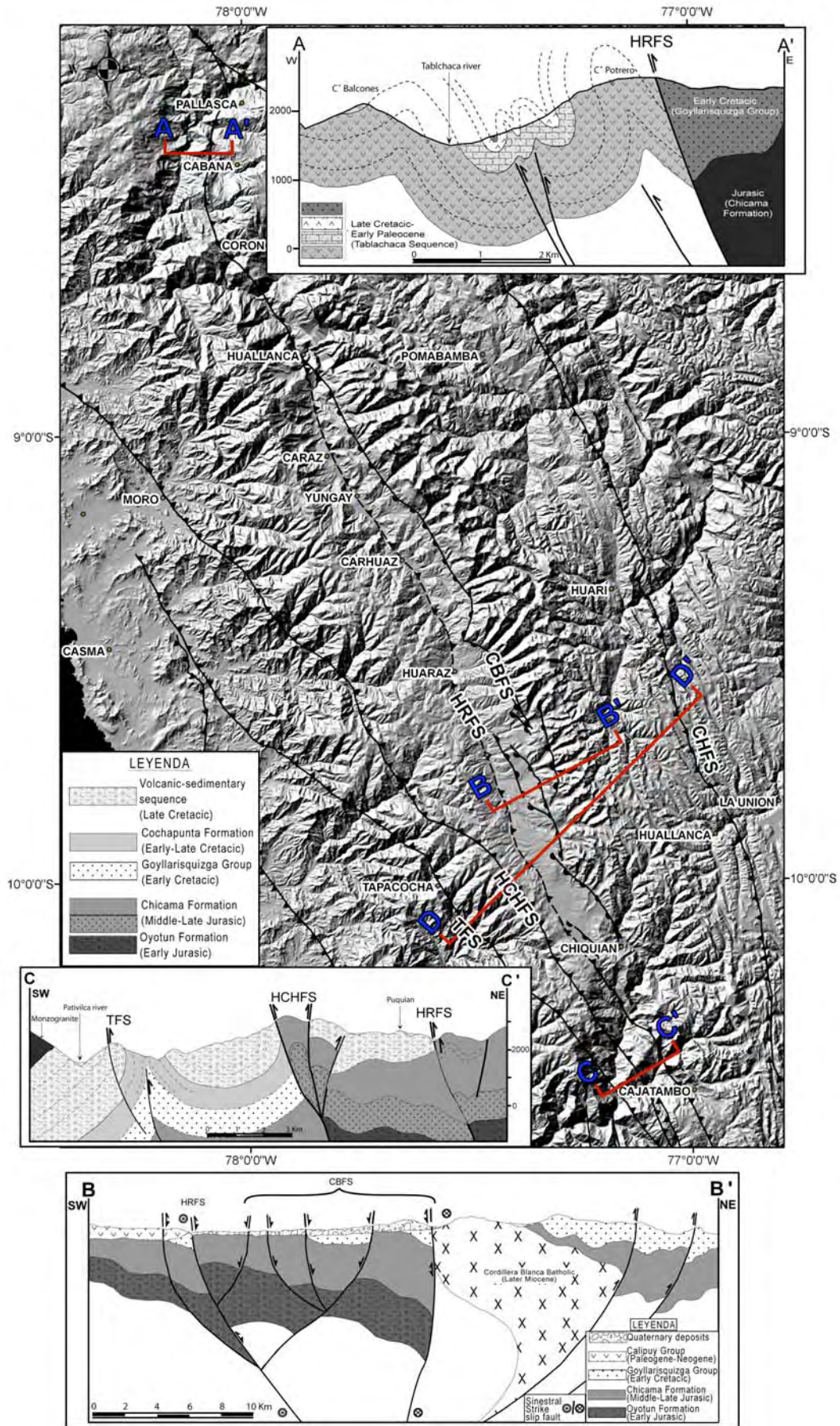


Figure 2.

The structural section B-B' is located in the central southern part of Cordillera Blanca fault system near Recuay town, from NE to SO direction, here we observe the Huaraz Recuay fault system as reverse with west dip and the Cordillera Blanca fault system as reverse with east dip, which due tectonic inversion actually show sinistral motion with normal component and generating a Plio-Quaternary basin with horst and graben showing NW to SE direction.

The section C-C' is located to the south, has NE to SW direction, near to Cajatambo town. Here we can observe the three western fault systems of the JKCHGB, corresponding reverse faults with west dip, affecting Jurassic rocks and the volcano-sedimentary sequence of Upper Cretaceous. This section is very important because we can observe in the HCH fault system a positive flower structure by tectonic inversion.

The section D-D', located in the central-southern part of Jurassic-Cretaceous Chicama-Goyllarisquizga basin, has a NE to SO direction, between Chiquian and Recuay towns. This section is more regional, cross the three stratigraphic basins and all fault systems that controlled the JKChGB. To the southwest we observe the Cochapunta Formation (Albian-Cenomanian) of the KVSCB basin and limited by the TFS. In the central part we observe the Jurassic-Cretaceous sediments controlled to the west by the Tapacocha, Huacllan-Churín, Huaraz Recuay fault systems, and to the east controlled by the Chonta fault system. These fault systems show clear distensive tectonic inversion to compressive. However, between the Huaraz-Recuay and Cordillera Blanca fault systems we observe sinistral motion with normal component that affect Plio-Quaternary deposits. Toward NE the Goyllarisquizga Formation is overlying with angular unconformity the Mitu-Pucara Group and the Paleozoic-Precambrian basement in the Mitu-Pucara basin. Therefore, this basin corresponds to a horst during the Cretaceous.

Conclusions

From the stratigraphic and structural analyses, we interpret that the Jurassic-Cretaceous Chicama-Goyllarisquizga basin was originated and controlled by the Tapacocha, Huacllan-Churín, and Huaraz-Recuay fault systems in the western boundary and by the Cordillera Blanca and Chonta fault systems in the eastern boundary of the basin. These faults at the beginning have presented normal motion, later due to compressive tectonic inversion change to reverse fault with west and east dip. Along the Chicama-Goyllarisquizga basin axes, limited by Cordillera Blanca and Huaraz-Recuay faults systems, we observe sinistral slip with normal component affecting Plio-Quaternary deposits. This last tectonic style indicates sinistral transtensive motion for the Cordillera Blanca zone.

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