TECTONIC EVOLUTION AND GEOLOGICAL HISTORY OF THE COLINA AND VOLCÁN RIVER VALLEYS IN THE HIGH ANDES OF SANTIAGO, CHILE

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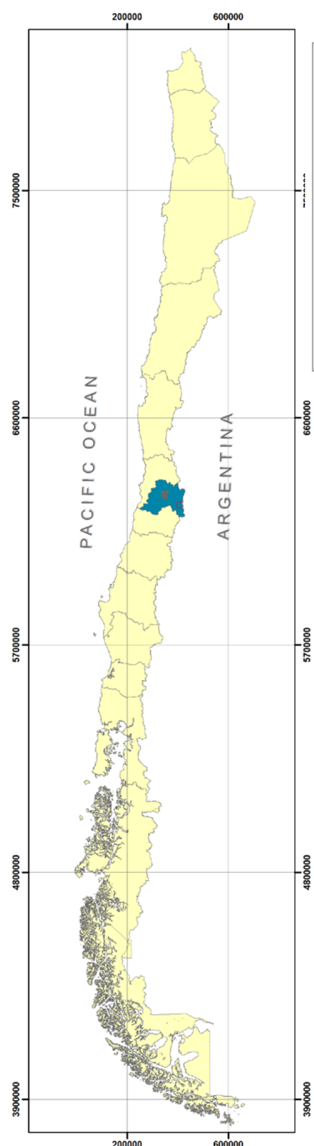
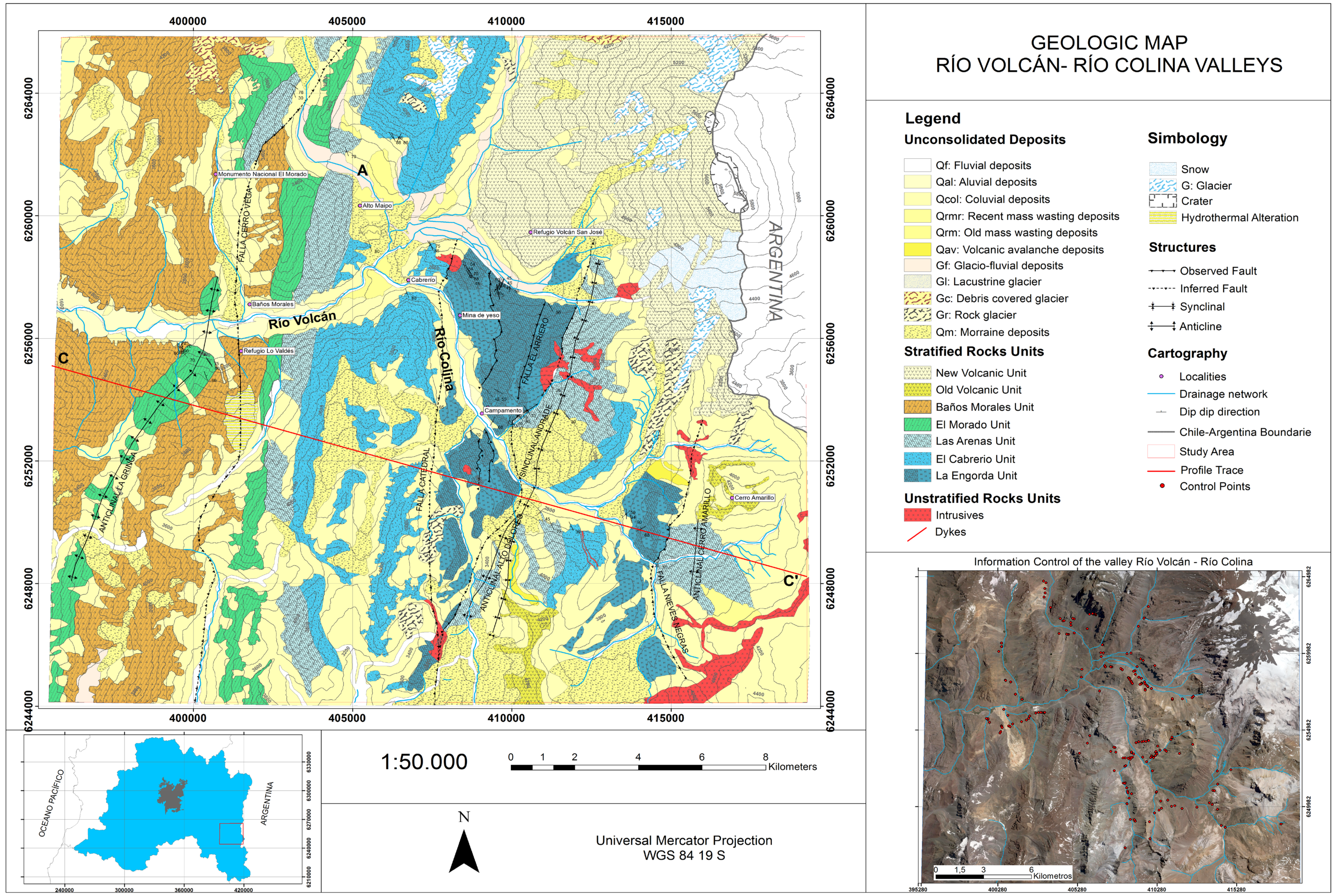
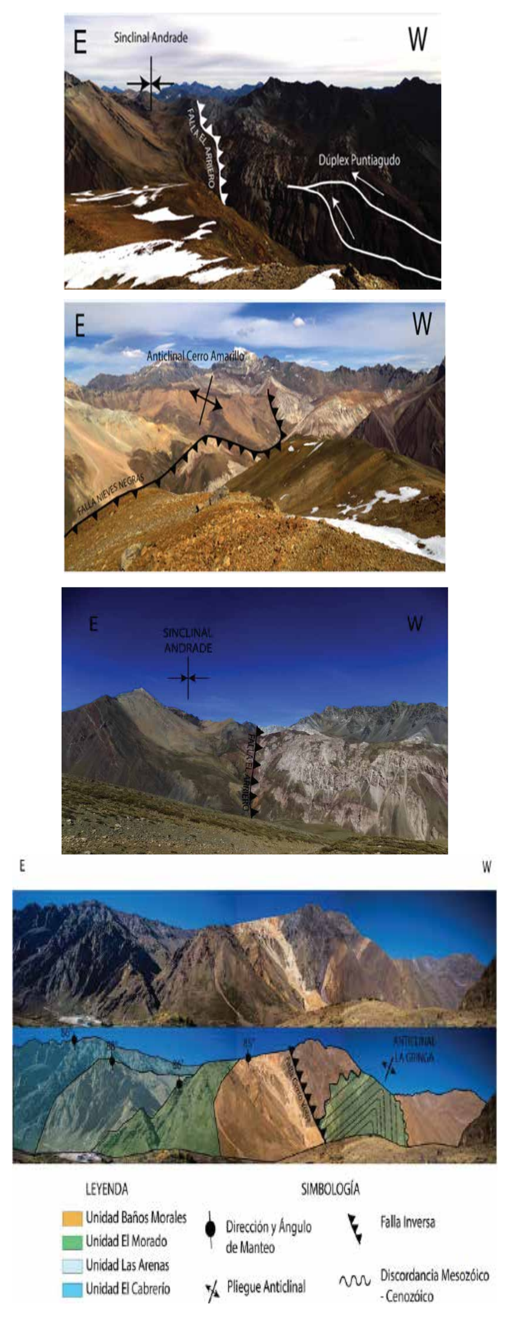




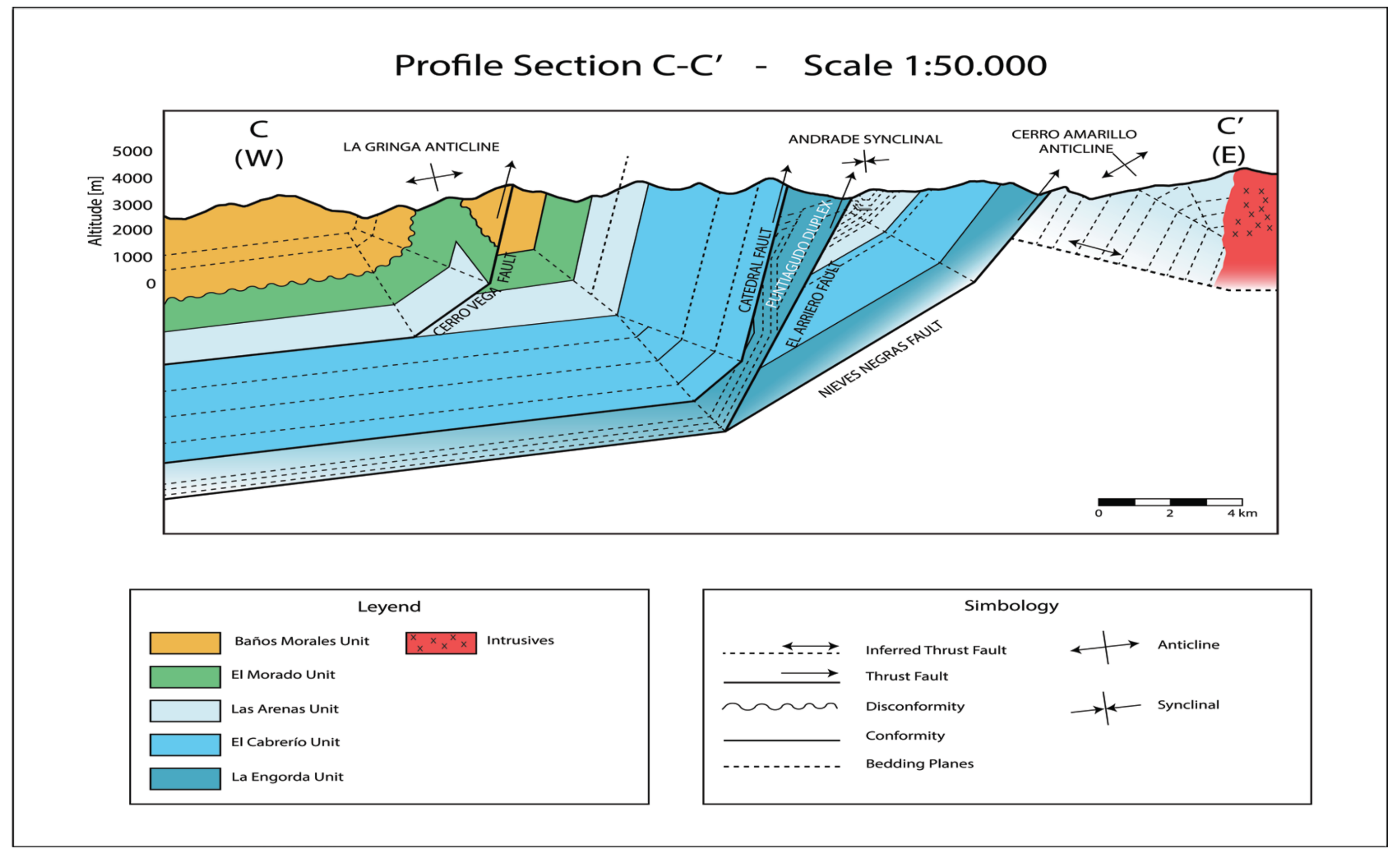
ABSTRACT

The eastern border of the Principal Cordillera in the Andes of Central Chile is characterized by a complex tectonics evolution, in which the development of the Aconcagua Fold and Thrust Belt is one of the main processes responsible for its modern configuration. This has motivated investigators, but despite the efforts, scientific knowledge has been insufficient to provide understanding of this structure and its role in the Andes. Between May 28 and April 7 2017, the course of Field Geology II of the University of Chile mapped this area at the scale of 1:50,000, with the objective to determine the tectonic evolution and geological history of the Colina and Volcán river valleys in the high Andes of Santiago. As a result, five lithostratigraphic units where recognized which correspond to La Engorda, El Cabrerío, Las Arenas, El Morado and Baños Morales which have been described in literature as Río Colina (González 1963), Río Damas (Klohn 1960), Lo Valdés (González 1963), Colimapu (Klohn 1960) and Abanico (Aguirre 1960) formations. These correspond to marine and continental sedimentary series. Quaternary units were defined, which are constituted by landslides, fluvial, alluvial and glacial deposits disposed in the valleys. Two different Quaternary volcanic units where described, corresponding to the recent volcanic products of San José Volcano, as well as a Plutonic unit. A cross section across the study area revealed the configuration of the Aconcagua Fold and Thrust Belt, characterized as an east-vergent thin-skin structure. Seven first order geological structures were defined; four of them correspond to east-vergent faults (Cerro Vega, Catedral, Arriero, and Nieves Negras faults), one of them corresponds to a west-vergent fault system (Sistema de Falla Puntiagudo) and two of them to west-vergent folds (Pliegue Andrade and Cerro Amarillo). Second order structures were also described corresponding to anticlines and inverse faults. It is proposed an east-vergent propagation of deformation with a minimal shortening estimated as 34 kms, equivalent to 53% of the initial configuration. These structures evidence a complex history of tectonic activity and can explain the modern configuration of the geological units defined in this work that together with exogenous erosive processes, modify the Earth's surface in this portion of the Andes.

STRUCTURES



Profile Section C-C' - Scale 1:50.000



TECTONIC EVOLUTION

I. Activation of the Cerro Vega Fault producing a shortening of 1 to 3 km and generating La Gringa Anticline.

II. Development of the Puntiagudo Duplex, formed by at least 2 thrusts faults that assemble and repeat stratigraphic sequences of La Engorda Unit producing a shortening of 5 km.

III. The Cathedral Fault to the W of the duplex mounts the El Cabrerío Unit on the La Engorda Unit in angular discordance. This fault cuts the duplex and produces a shortening of 5 km.

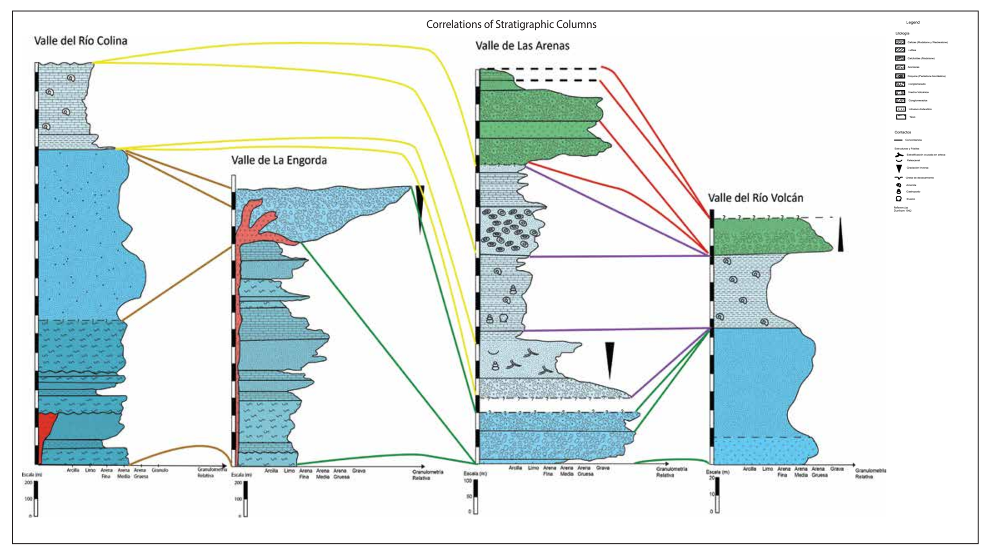
IV. The El Arriero Fault to the E of the duplex raises the La Engorda and El Cabrerío Units generating a shortening of 10 -12 km, evidenced also by the formation of the Andrade. Sinclinal

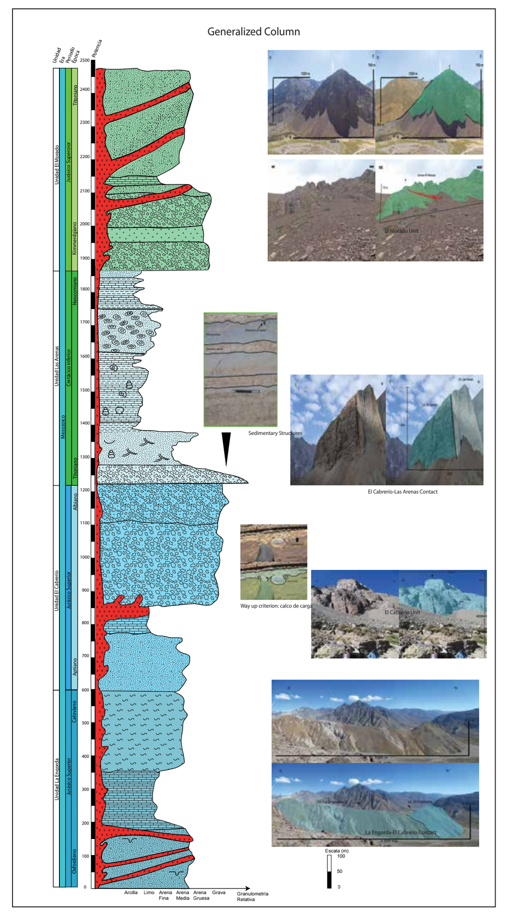
V. The Nieves Negras Fault to the E of the El Arriero Fault raises even more the dips of the faults and strata of all the Units to the west, verticalizing the El Cabrerío and El Morado Units, resulting in a shortening of 12 km

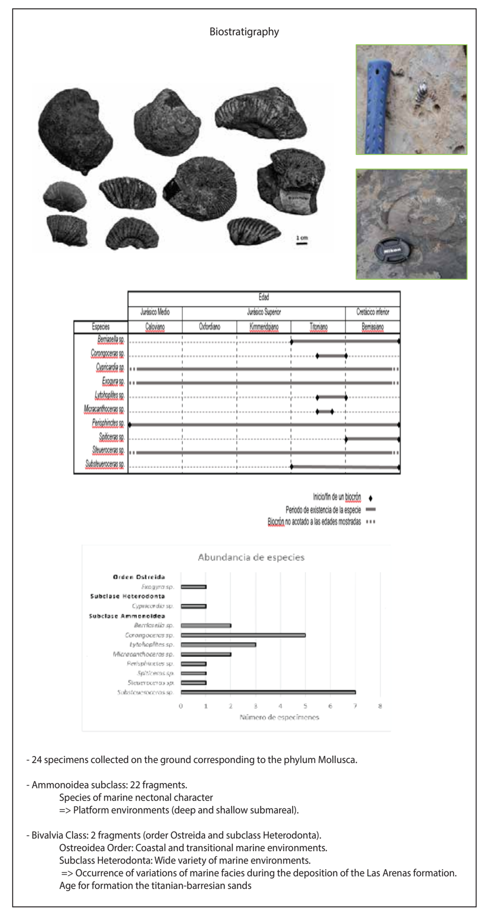
VI. Inversion of the Cerro Amarillo Fault to the east of the Nieves Negras Fault, which generates the Cerro Amarillo Anticlinal, increasing the dip angle of the structures and units to the W, generating a shortening of 1 km.

VII. An unidentified fault to the east of the entire study area raises the Nieves Negras Fault, explaining its high angle.

STRATIGRAPHY



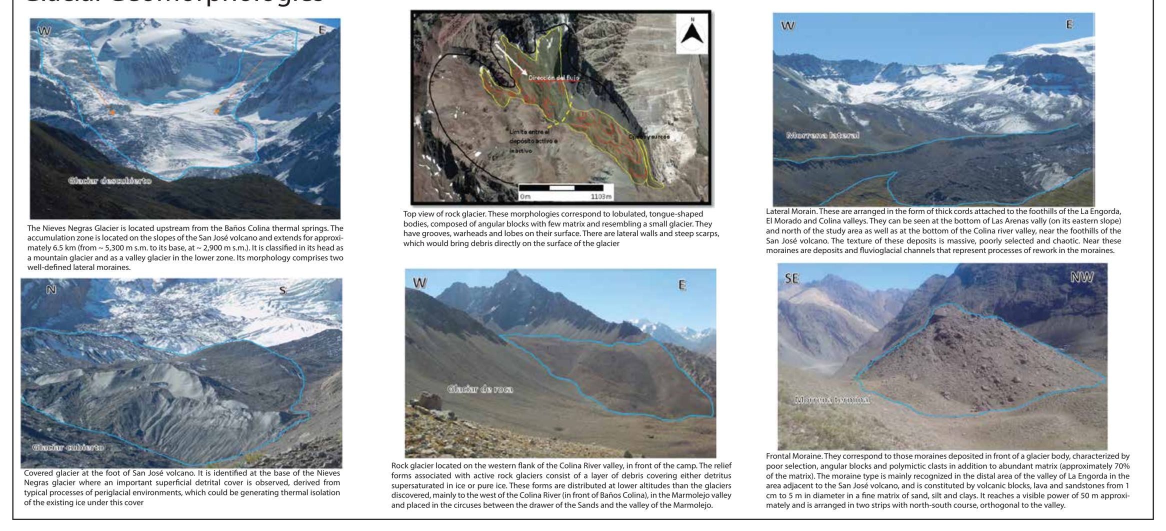




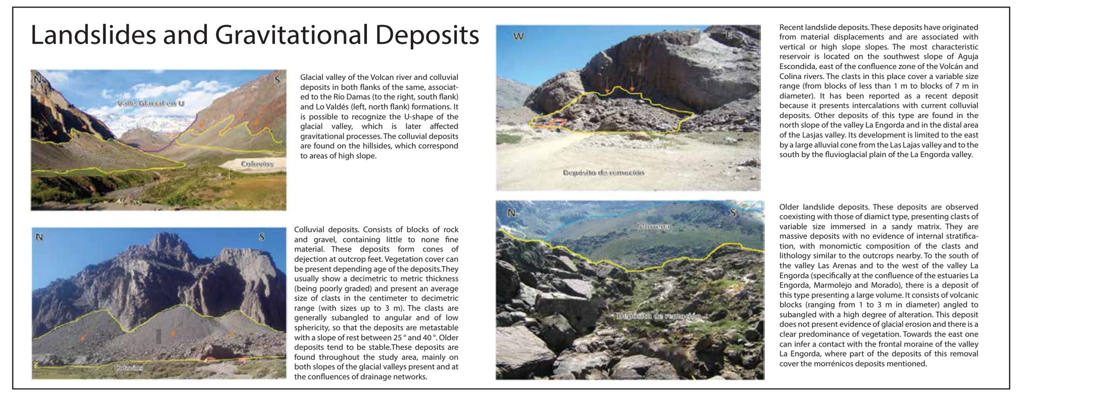
GEOMORPHOLOGY

Geomorphology in the area is controlled by different natural processes as is climate, tectonics, erosive and sedimentation processes. The climate corresponds to semiarid in low temperature conditions. This allows the action of glaciers and their associated morphologies (moraines, U shape valleys, rock glaciers, and others) and mechanical and chemical weathering (producing gelifraction and cryoclast and dissolution and other processes respectively).

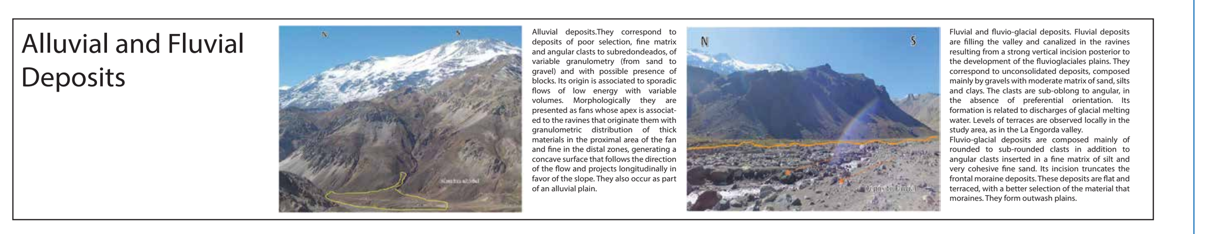
Glacial Geomorphologies



Landslides and Gravitational Deposits



Alluvial and Fluvial Deposits



Landscape Evolution

1. Tectonic uplift due to a compressive regime associated with the subduction and consequent deformation processes of the relief.

2. Pleistocene Glaciation recognized in Lo Valdés, El Morado, Baños Morales areas and higher altitudes, with predominance of valley glaciers. This glaciation was defined by Borde (1966) as the later glacial phase within the third glaciation indicated by Brüggen (1950), and that is evidenced by moraine deposits in all the valleys studied.

3. Diachronic retreat of glaciers in La Engorda, Colina and Las Arenas valleys. The most recent glacial deposits of Las Arenas valley would indicate that the ablation processes acted later in this valley, a phenomenon that could be explained by the orientation of the valley with respect to the incidence of solar radiation on it. The opposite occurs in the Colina river valley, where glacial processes are superimposed largely by gravitational deposits, alluvial and fluvial processes, indicating an earlier glacial ablation with respect to the rest of the valleys. This phenomenon would have a possible explanation for a higher incidence of solar radiation because this valley faces north.

REFERENCES