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Slope instabilities along the Western Andean Escarpment and the main canyons in Northern Chile

G. Crosta (1), R.L. Hermanns (2), E. Valbuzzi (1), J. Dehls (2), F.X. Yugsi Molina (2), and S. Sepulveda (3)

(1) Università degli Studi di Milano-Bicocca, Dipartimento di Scienze Geologiche e Geotecnologie, Italy (giovannibattista.crosta@unimib.it), (2) Geological Survey of Norway, Trondheim, Norway , (3) Depto. Geologia, Universidad de Chile, Santiago, Chile

The western slope of the Andes of northern Chile – southern Perù is generally subdivided from the west to the east into the morphological units of: the Coastal Cordillera, Central Depression, the Western Escarpment-Precordillera and the Western Andean Cordillera. The western escarpment and Precordillera are formed by the Azapa coarse-grained clastic formation (sandstones, conglomerates, mudstones) and the Oxaya (rhyodacitic ignimbrites) and Diablo volcanoclastic formations (Oligocene and Miocene). Important uplift has been suggested between the deposition of the Oxaya and Diablo formations. The entire area has been characterized by a long-term hyperaridity (Atacama desert), initially established between 20 and 15 Ma, and this caused a strong difference between the long term continuous uplift and low denudation rates.

This long sector of the central western escarpment and Precordillera is incised by deep canyons and subparallel drainage network in the upper part. The drainage network developed in two main phases: a lower–middle Miocene phase with formation of a parallel poorly structured drainage network cutting into the Oxaya formation, and presently well preserved; the canyons have been incised in the initial topography starting around 9 Ma and up to about 3.8 Ma with subsequent refilling episodes. Valley incision (ave. rate of 0.2 mm yr^{-1}) has been controlled by topographic uplift and less arid climate (after 7 Ma).

As a consequence of these geologic and climatic settings the evolution of this area has been characterized by canyon incision and extremely large slope instabilities. These slope instabilities occur in the "interfluvial" sectors of the western escarpment and Precordillera and along the canyon flanks.

Landslides affecting the preserved paleosurfaces, interested by the parallel drainage network in the Oxaya formation, involve volumes of various cubic kilometres (Lluta collapse, Latagualla Landslide) and can control the drainage network. These mega landslides can be classified as large block slides and can evolve in large rock avalanches. Their initiation seems to be strongly associated to the presence of secondary faults and large fractures transversal to the slope. Furthermore, most of these landslides show evidences suggesting a re-incision by the main canyon network.

Landslides along the canyon flanks affect volumes lower than 1 km3 and can be mainly classified as large complex slumps. The deposits of these landslides often cross the valley and have been incised exposing undeformed bedrock material. At the same time large boulder fields and alluvial deposits infill the lower part of the canyons suggesting also a long history of dam breaching events.

We present a landslide inventory in the area (about 220 km long and 80 km wide) between Pisagua (19.4° Chile) and Tacna (17.5° Perù) to the NE of the Arica bend. We mapped landslides, main tectonic structures and other morphological features. Mapping has been performed by use of satellite images, Google Earth® and field surveys performed in the last few years. We discuss two specific landslide sites, the Cerro Caquilluco–Cerrillos Negros rock slide–avalanche (Tacna, Tomasiri, Perù) and a small group of rock avalanches south of Iquique (Chile) in two other abstracts presented by the authors at this conference