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Redefinition of the Horcones Deposit as related to postglacial Collapse of Cerro Aconcagua makes necessary redefining glacial Stratigraphy of Horcones-, Las Cuevas- and Mendoza valley, Argentina

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Scientists have long debated the formation of the Horcones deposit at the confluence of Horcones and Las Cuevas valley. Resolving the dispute is critical to define the glacial stratigraphy in these valleys. The deposit was mapped as moraine and as a landslide deposit from collapsed glacio-fluvial deposits. We dated the deposit, associated lake and fluvial sediments, conducted sedimentological and morphological analyses to reach an alternative solution. The deposit was mapped for about 10 km below the terminus of Horcones glacier. At the upper end it is composed of a single lithology representing Cerro Aconcagua south face, and is mineralogically distinct from lateral moraine deposits of the last glaciation. In addition, clasts are very angular and internally fractured. The morphology is hummocky and the deposit has a run-up of $\sim$100 m at a 90° bend of the valley. No material was found where Horcones valley forms a narrow gorge, but the hummocky deposit fills the entire valley floor in its lower 4 km. It is tens of m thick, its centre higher than the margins. Here the deposit consists largely of thoroughly crushed and broken, grey rock of the Cerro Aconcagua lithology but with inclusions of red material with sub-angular to sub-rounded clasts. The latter involve various lithologies outcropping along the Horcones valley and found in lateral moraines of the last glaciation. Boundaries between the two materials are sharp. ^{36}Cl

surface exposure ages of the deposit vary between 8,300 and 11,400 years with overlapping uncertainties, while ^{14}C ages of underlying fluvial deposits are 12,640 cal yr BP. This interval is marked by sediments deposited into a lake (13,670 – 9,180 cal yr BP) of the Las Cuevas valley which was dammed by the Horcones deposit. Therefore we conclude that the latter was formed by two large rock slope failure on Cerro Aconcagua, traveled onto Horcones glacier as a rock avalanche, and was transformed to a saturated mass flow that entrained moraine deposits from the glacier margins and fore-field, its main mass emplaced up to 20 km from Cerro Aconcagua as a mixture of the source rock and glacial materials. Lateral moraine deposits initially mapped as belonging to an earlier glaciation than the Last Glacial Maximum (LGM) have ^{36}Cl ages of 14.8 – 17.0 ka. We also analyzed the deposits interpreted as terminal moraines of this earlier glaciation. Again we conclude that these are deposits of a highly mobile landslide. The ^{36}Cl ages of those deposits are again late Pleistocene and post LGM. We suspect post-glacial climatic conditions were a conditioning factor of these multiple large landslides and it is conceivable that climate warming could lead to similar events in future.