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From 'true' glaciers to rock glaciers? The case of the Llanos la Liebre rock glacier, dry Andes of Chile.

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In the dry Andes of Chile, rock glaciers are the most widespread and remarkable superficial landforms, and may constitute important solid water reservoirs. The existence of huge (up to 2-3 kilometres of length) rock glaciers located in deep cirques questions possible derivation from former 'true' glaciers. The issue is of importance (i) for understanding the mechanisms of the landscape evolution from glacial realm to periglacial realm, and (ii) because it may determine the ice content of the concerned rock glaciers. In the Colorado Río valley, in the upper part of the Elqui catchment (∼30.15 deg. S and 70.80 deg. W), we investigated the internal structure of the Llanos la Liebre rock glacier using ground-penetrating radar (GPR). With 50 MHz antennas and a constant offset of 2 m between antennas, we performed various GPR profiles, especially a ∼2.2 km-long one almost covering the entire length of the rock glacier. The processing and the subsequent interpretation of the GPR data were mainly based on the modelling of the radar wave velocity. Hence, the final representation of the internal structure of the rock glacier integrates the reconstructed stratigraphy, the 2-D velocity model, and first attempts for estimating the ice/water contents. The most striking results are: the neat identification of the base of the superficial blocky layer and of the rock glacier floor; the occurrence of stratigraphic patterns reminiscent of 'true' glaciers; the supremacy of high radar wave velocities in the upper part of the rock glacier. On the latter bases and taking into account the whole geomorphology of the site, the derivation of the Llanos la Liebre rock glacier from a former, buried glacier is debated.