



Glacial and volcanic evolution on Nevado Coropuna (Tropical Andes) based on cosmogenic ^{36}Cl surface exposure dating

J. Úbeda (1), D. Palacios (1), and L. Vázquez-Selém (2)

(1) Dep. AGR y Geografía Física. Universidad Complutense. Madrid. Spain., (2) Instituto de Geografía, Universidad Nacional Autónoma de México, México D.F. MEXICO.

We have reconstructed the evolution of the paleo-glaciers of the volcanic complex Nevado Coropuna (15°S, 72°W; 6377 m asl) through the interpretation and dating of geomorphological evidences. Surface exposure dating (SED) based on the accumulation of ^{36}Cl on the surface of moraine boulders, polished bedrock and lava flows allowed: 1) to confirm that the presence of ice masses in the region dates back to >80ka; 2) to produce chronologies of glacial and volcanic phases for the last ~21 ka; and 3) to obtain evidences of the reactivation of volcanic activity after the Last Glacial Maximum.

Bromley et al. (2009) presented ^3He SED ages of 21 ka for moraine boulders on the Mapa Mayo valley, to the North of Nevado Coropuna. Our ^{36}Cl SED for moraine boulders from the valleys on the NE sector of the volcanic complex suggest a maximum initial advance between 20 and 16 ka, followed by another expansion of similar extent at 12-11 ka.

On the Southern slope of Nevado Coropuna, the ^{36}Cl ages show a maximum initial advance that reaches to the level of the Altiplano at 14 ka, and a re-advance at ~10-9 ka BP. Other data show minor re-advances at 9 ka on the Northern slope and at 6 ka to the South of the volcanic complex. These minor positive pulses interrupted a fast deglaciation process during the Holocene as shown by two series of ^{36}Cl SED from polished rock surfaces on successively higher altitudes along the valleys of rivers Blanco and Cospanja, to the SW and SE.

Despite the global warming occurring since 20 ka, deduced from the record of sea surface paleo-temperature of the Galapago Islands (Lea et al, 2006), the evolution of the fresh-water plankton from Lake Titicaca (Fritz et al, 2007) is consistent with sustained glacial conditions until 10-9 ka as suggested by the present work.

Exposure ages of three lava flows indicate a reactivation of the magmatic system as the paleo-glaciers abandoned the slopes. The eruptive activity migrated from the West, where we found a lava flow of 6 ka, to the East, where we dated two units similar to the previous one at 2 and <1ka.

Bromley, G.R. et al., 2009. Relative timing of last glacial maximum and late-glacial events in the central tropical Andes. *Quaternary Science Reviews*, 1-13.

Bromley, R.M. et al., 2011. Glacier fluctuations in the southern Peruvian Andes during the late-glacial period, constrained with cosmogenic ^3He . *Journal of Quaternary Science*, 26 (1): 37-43.

Fritz, S.C. et al., 2007. Lake Titicaca 370KYr LT01-2B Sediment Database. Lake Titicaca 370KYr LT01-2B Sediment Data. IGBP PAGES/World Data Center-A for Paleoclimatology Data Contribution Series # 92-008. NOAA/NGDC Paleoclimatology Program, Boulder (EEUU).

Lea, D.W. et al., 2006. Galápagos TR163-22 Foraminiferal [^{18}O] and Mg/Ca Data and SST Reconstruction. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series # 2006-090. NOAA/NCDC Paleoclimatology Program, Boulder (EEUU).

Research funded by CGL2009-7343 project, Government of Spain.