
Late Pleistocene thrust tectonics in the north Peruvian forearc revealed by Terrestrial Cosmogenic Nuclides surface exposure dating, field structural data and seismic profiles

Andréa Peuzin*¹, Marianne Saillard, Nicolas Espurt¹, Régis Braucher², Marc Régnier³,
Guillaume Duclaux¹, Laurence Audin⁴, Adriana Lemgruber Traby⁵, Olivier Bellier⁶,
Jean-Claude Hippolyte⁶, and Ysabel Calderon⁷

¹Géoazur – Université Côte d’Azur, IRD, CNRS, Observatoire de la Côte d’Azur, Géoazur, Valbonne –
France

²Centre européen de recherche et d’enseignement de géosciences de l’environnement – CNRS :
UMR7330 – France

³Géoazur – Université Côte d’Azur, IRD, CNRS, Observatoire de la Côte d’Azur, Géoazur, Valbonne –
France

⁴Institut des Sciences de la Terre – Institut de Recherche pour le Développement – France

⁵IFP Energies nouvelles – IFPEN, IFP Energies nouvelles, 1 et 4 avenue de Bois-Préau, 92852
Rueil-Malmaison, France. – France

⁶Centre européen de recherche et d’enseignement des géosciences de l’environnement – Centre National
de la Recherche Scientifique – France

⁷PERUPETRO S.A., Avenida Luis Aldana 320, San Borja, Lima 41, Peru – Pérou

Résumé

Precise dating of geomorphic markers that are subject to thrust-related deformation, such as alluvial fan surface are crucial for quantifying forearc deformation, especially in a context of weak interseismic coupling on the subduction interface as in northern Peru. In this study, we document the late Pleistocene tectonic history of the Amotape massif, which is a prominent basement relief in the northern Peruvian forearc. To achieve this, we combine a morphometric analysis and Terrestrial Cosmogenic Nuclides (TCNs) surface exposure dating of alluvial fan surface with subsurface structural data. TCNs (¹⁰Be and ²⁶Al) surface exposure ages of alluvial fan surfaces on the northwestern flank of the massif range from 35.1 ± 1.1 ka to 59.3 ± 2.1 ka for ¹⁰Be and from 27.3 ± 2.0 ka to 48.9 ± 2.5 ka for ²⁶Al. Both cosmogenic nuclides provide consistent results. We calculated a mean weighted age of 39.0 ± 0.3 ka for an alluvial fan that is offset by a major NW-verging thrust. Our results provide an estimated slip rate of 1.15 ± 0.46 m/ka along the Amotape thrust front since the late Pleistocene. The surface deformation along the Amotape thrust front correlates with the top portion of a deep-seated contractional wedge involving the crustal basement, according to subsurface structural data and regional seismicity. This integrated analysis demonstrates active shortening in the onshore crustal basement of the northern Peruvian forearc where no active thrust reaching the surface has been described before.

*Intervenant

Mots-Clés: ^{10}Be and ^{26}Al cosmogenic isotopes, alluvial fans, active shortening, morpho, tectonic markers, Northern Andean forearc