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Geomorphologic and Stratigraphic relationships as indicators of Upper Pleistocene– Holocene climate change and Tsunami Hazard, central coast of Ecuador

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Geomorphic and stratigraphic studies and radiometric dating techniques applied to Quaternary sedimentary sequences located on the Jaramijo site (Ecuador's central coast, South America), allowed to recognized upper Pleistocene to Holocene uplifted terraces. The marine terraces, from bottom to the top, are: T1 at an altitude of 20 meters a.s.l. (above sea level) (dated 1.190 ± 30 BP to 1.030 ± 30 years BP), T2 terrace at 30 meters a.s.l (43.245 ± 460 years B.P.) and T3 at an altitude between 43 to 57 meters a.s.l. (ca. 120.000 years). The T3 terrace was previously recognized by Pedoja et al. (2006) [1], but our research outlined two new terraces (here named T1 and T2) mostly covered by volcanic-ash deposits. This paleogeographic reconstruction is linked with the continental margin active tectonic and MIS1 to MIS 3 (Marine Isotope Stages) glacial and interglacial stages. EJ-02 sample is referred to theT2 terrace, the EJ-02E lithologic unit is composed by medium sand with plentiful bivalve molluscs indicating a sublittoral zone, where sediments probably were deposited in a water column from 0 to 30 meters deep. The radiocarbon age of this unit is 41.295 to 40.140 years BC (cal. 43.245 to 42.090 years BP). The $\delta\ ^{18}O$ and -1 to -1.5 o/oo values can be associated with a short interstadial stage within the glacial period MIS 3, associated to a rapid sea level rise reached -10 to -20 m bellow of current level.

EJ-01 and EJ-03 geological sampling stations were located on the T1 terrace. The main geomorphologic features of this terrace are a wave-cut beach platform permanently exposed at the lowest tides and an 18 m-high coastal cliff retreating ca. 1.5 to 2.5 meters/year [2]. T1 terrace is composed by Late Holocene sequences of sand and clay sediments intercalated with loose to weakly consolidated volcanic-ash layers. One of the most remarkable geoarchaeological findings in this outcrop (EJ-01E sample) were human bones related with Manteña culture integration period, within a 8 to 25 cm-thick volcanic ash layer [3] (radiocarbon dating of 1.190 ± 30 B.P.). The EJ-01D unit is one of the most important sedimentary levels that provide tsunami hazard information. This layer presents an upper and lower erosive contacts and chaotic deposition of medium to fine-grained sand. Inside the matrix are present Melonis sphaerodis foraminifera of bathyal environment, indicating a possible tsunami deposit with 6.3 meters a.s.l. run-up height (estimated age of ca. 1.200 ± 30 B.P.).

All of these stratigraphic and palaeoseismologic features will allow us to understand the catastrophic series of geological events that abruptly shaped the landscape (such as subduction earthquakes, local

tsunami, and volcanic lahar-ash landslides). The Jaramijo site tectonic uplift rate (ca. 0.5 to 0.98 mm/year) allows to preserve the well formed marine terraces outcropping in central coast of Ecuador.

References:

[1] Pedoja, K. et al. (2006). Journal of South American Earth Science, 22, 1-21.
[2] Chunga et al. (2015). Abstract EP23B-0979. AGU Meeting.
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