SINT-2: Sismotectónica, el ciclo de terremotos y paleosismología a lo largo del margen chileno

Dating co-seismic coastal subsidence events using ^{14}C and dendrochronology in the region of the 1960 giant earthquake

Cyntia Mizobe[2,1], Marco Cisternas[3,1], Gino Figueroa[2,1], Ariel Muñoz[4].
(1) Millennium Nucleus The Seismic Cycle Along Subduction Zones
(2) Programa de Magister en Oceanografía, Ciencias del Mar y Geografía, Pontificia Universidad Católica De Valparaíso
(3) Escuela de Ciencias del Mar, Ciencias del Mar y Geografía, Pontificia Universidad Católica De Valparaíso, Valparaíso, Chile
(4) Instituto de Geografía, Ciencias del Mar y Geografía, Pontificia Universidad Católica de Valparaíso

We develop a way to date past co-seismic coastal subsidence events using standard radiocarbon analyses and dendrochronological techniques on roots of trees killed by the effects of such land level change. Today, the coast affected by rapid subsidence accompanying the giant 1960 Chile earthquake still shows well-preserved remains of trees, mainly their roots, half-buried by coastal sediments. We found buried similar roots kilometers inland in Pangal, a sandy beach-ridge plain midway along the 1960 earthquake area. Using the 1960 analog, we interpreted such fossil roots as also associated to past subsidence events. In an effort to date the events, we carried out radiocarbon analyses of the outer growth rings and bark of the fossil roots. However, some of the age ranges resulted so wide (~100 years) that the ages of different events overlapped. To address this problem, we propose to constrain the radiocarbon dates by crossdating the growth rings of the roots with long-term regional master chronologies of alerce (Fitzroya cupressoides), a long-lived native tree well studied by dendrochrologists. To validate this approach, we first conducted a test using the 1960 event as a modern analog. We sampled the roots of 25 stumps from trees killed by the 1960 subsidence. The roots were sliced, sanded and mounted on thin slides to recognize and mark the rings under microscope. The marked slices were scanned and the rings were counted and measured using the WinDendro software. The series was internally cross-dated with the COFECHA software to obtain a chronology of the 1960 roots. Currently, we are cross-dating our 1960 chronology with seven nearby master chronologies of alerce. Because the radiocarbon analyses usually give age ranges of ~100 years, and the event occurred 58 years ago, we are using the last century of the alerce chronologies as a temporal window. We expect that the results will recognize the trees were killed in 1960. If so, this approach would allow first to date past co-seismic events more precisely and then to understand better the seismic cycle in the region of the largest earthquake ever measured. Research funded by Fondecyt N°1150321, and has been supported by Iniciativa Científica Milenio (ICM) through grant NC160025 "Millennium Nucleus CYCLO: The Seismic Cycle along Subduction Zones"