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# Using paleomagnetism to expand the observation time window of plate locking along subduction zones: evidence from the Chilean fore-arc sliver (38ºS – 42ºS)

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Fore-arc crustal motion has been usually addressed by the analysis of earthquake slip vectors and, since the last twenty years, by velocity [U+FB01]elds derived from Global Positioning System (GPS) data. Yet this observation time window (few decades) can be signi[U+FB01]cantly shorter than a complete seismic cycle or constrained to interseismic periods where the postseismic deformation release, the vicinity of other important faults, and the slip partitioning in oblique subduction may hinder the [U+FB01]nite deformation pattern.
Paleomagnetic data may yield [U+FB01]nite rotations occurring since rock formation, thus provide a much longer observation time span in the order of millions or tens of millions of years. The cumulative permanent or nonreversing deformation in function of the considered geological formation age can represent the average over many seismic cycles, thus signi[U+FB01]cantly complement "instantaneous" information derived from seismic and GPS data.

With the aim of evaluate the strike-variation and evolution of the plate coupling along the Chilean subduction zone, here we report on the paleomagnetism of 43 Oligocene-Pleistocene volcanic sites from the fore-arc sliver between 38°S and 42°S. Sites were gathered west of the 1000 km long Liquiñe-Ofqui dextral fault zone (LOFZ) that represents the eastern fore-arc sliver boundary. Nineteen reliable sites reveal that the fore arc is characterized by counterclockwise (CCW) rotations of variable magnitude, except at 40°S - 41°S, where ultrafast (>50°/Myr) clockwise (CW) rotations occur within a 30 km wide zone adjacent to the LOFZ. CCW rotation variability (even at close sites) and rapidity (>10°/Myr) suggest that the observed block rotation pattern is related to NW-SE seismically active sinistral faults crosscutting the whole fore arc. According to previously published data, CW rotations up to 170° also occur east of the LOFZ and have been related to ongoing LOFZ shear. We suggest that the occurrence and width of the eastern fore-arc sliver undergoing CW rotations is a function of plate coupling along the subduction zone interface. Zones of high coupling enhance stress normal to the LOFZ, induce high LOFZ strength, and yield a wide deformation zone characterized by CW rotations. Conversely, low coupling imply a weak LOFZ, a lack of CW rotations, and a fore arc entirely dominated by CCW rotations related to sinistral fault kinematics. Our locking inferences are in good agreement with those recently derived by GPS analysis and indicate that seismotectonic segment coupling has remained virtually unchanged during the last 5Ma.