Possible Evolution of Volcanic Activity of a subducting spreading ridge at the Chile Triple Junction based on geomagnetic survey data

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The Chile Triple Junction (CTJ), an Ridge-Trench-Trench type triple junction located at 46°13′S, 75°48′W off Taitao Peninsula, the western coast of Chile, is characterised by the subducting Chile Ridge, which is the constructive plate boundary that generates both the Nazca Plate and the Antarctic Plate. The ridge subduction mechanism and the regional tectonics around the CTJ were investigated primarily using marine geomagnetic data collected during the MR16-09 cruise Leg 1 and2 implemented in 2016-17 by R/V MIRAI together with the RD1803 cruise in 1975 by R/V Robert D. Conrad. A long transect on the Segment SCR3 (by Mirai cruise) and two short transects on the Segments SCR3-2 and SCR2-1 (by Conrad and Mirai cruises) are examined in order to estimate a possible variation of the spreading rates before subduction. Distances between the Chile Trench and Chile Ridge crest on Segment SCR3, SCR2 and SCR1 are 150km, 30km and 0km, respectively. The result shows that the spreading rate on the Segment SCR3 is 40-35mm/year, almost constant up to the ridge crest 150km away from the trench. However, the spreading rate on the Segment SCR1 located in the neighbour of the trench is almost 10mm/year. This suggests that volcanic activity diminishes towards the subducting ridge axis. The lithosphere under the Chile Ridge might have amalgamated with the surrounding oceanic lithosphere due to heat loss after the cessation of volcanic activity at the trench. The oceanic lithosphere towards the trench also thickens rapidly due to heat loss, according to the residual gravity anomaly (gravity anomaly calculated by replacing the density of sea water and the whole crustal materials into that of the uppermost mantle), as is taking place in the western Pacific subducting lithosphere. Consequently, shallow-angle subduction of the even youngest and most immature oceanic plate occurs smoothly via slab-pull force without any resistance along the boundary with the South American continental plate.

Keywords: Chile Triple Junction, Geomagnetic anomaly, Spreading rate

