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Preliminary Assessment of the Puchuldiza-Licancura Geothermal Field in the Central Andean Volcanic Zone, northern Chile

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Despite the presence of a large number of active volcanoes along the Andean Belt, geothermal energy production in South America remains largely undeveloped [e.g. 1, 2]. In Chile, potential geothermal sites were recognized as early as the 1900´s [3, 4], but had to face political, technical and economic barriers which tampered further exploration and development [e.g. 4]. Currently, there is no installed geothermal capacity in the country, yet several exploration projects are underway. Exploration has focused mostly on determining heat capacity conditions through geochemical and/or geophysical studies [e.g. 5, 6, 7]. Although structural elements play a key role in the development of a geothermal field, acting as barriers or conduits for the migration and transport of fluids [e.g. 8], only limited work has been conducted on the tectonic setting and structural controls of geothermal reservoirs in the Central Volcanic Zone of the Andes (ca. 15º-28ºS) (CVZ) [9]. Here, several geothermal fields have been identified, including El Taitao/La Torta and Puchuldiza-Licancura [e.g. 10]. At El Tatio geothermal field, fractures and faults strike N- and NW-ward, and form a N-striking graben-like structure. This configuration of structural elements and their kinematics allow transport of heated waters towards the surface [e.g. 10]. At the Puchuldiza-Licancura geothermal field (ca. 19.1ºS), analyses of Google Earth© and ASTER images reveal the presence of a series of lineaments with N-, NW- and NE-trending preferential orientations. At the Puchuldiza area, N- and NW-striking structural elements dominate, whereas at Licancura NW- and NE-striking do. At Puchuldiza, N-striking structural elements have been identified as normal faults in the field, forming a graben-like structure [e.g. 10]; a configuration that allows vertical transport of fluids. At Licancura, no evidence of normal or dip-slip displacement were observed, but instead of strike-slip deformation. NE-trending lineaments seem to be strike-slip faults that cut and displace Mesozoic folds near the Salar de Surire, ca. 30 km NE of Licancura. NW-trending lineaments at Licancura seem to be continuous with N-striking normal faults observed at Puchuldiza, suggesting a bend or change in the trace of a potential N-to-NW-trending fault system, which could control the ascent of fluids if it has a transtensional character (i.e. strike-slip and extension components of displacement). Additionally, alteration patterns were obtained from different band combinations of ASTER images. Alteration mineralogy corresponds to paragenetic associations of: (1) kaolinite, dickite, pirophylite, alunite and quartz, (2) kaolinite and smectite, and (3) chlorite and epidote, which represent areas of advance argillic, argillic and propilitic alteration. Interestingly, advanced argillic alteration occurs spatially associated with NW-striking structural elements at Licancura and with N- and NW-trending lineaments at Puchuldiza [e.g. 10]. This is indirect evidence that structural elements at Licancura may be acting as conduits for the ascent of geothermal fluids towards shallower levels of the crust, as well as the possible transtensional character of NW-trending structural elements at the Licancura geothermal Field.

[1] Lahsen et al. (2015) Proceedings of the world geothermal congress, Melbourne, Australia

[2] Aravena et al. (2016) Geothermics, 59, 1-13
[3] Lahsen et al. (2010) Proceedings of the world geothermal congress, Bali, Indonesia
[4] Sánchez-Alfaro et al. (2015) Renewable and Sustainable Energy Reviews 51, 1390-1401.
[5] Urzúa et al. (2002) Geothermal Research Council Transactions, 26, 22-25.
[6] Cortecci et al. (2005) Geochemical Journal, 39, 547-571
[7] Cappaccioni et al. (2009) GeoActa Special Publication 2, 59-73
[8] Moeck (2014) Renewable and Sustainable Energy Review 37, 867–882
[9] Thorpe et al. (1981) Philosophical Transactions of the Royal Society of London, A301, 305–320
[10] Tassi et al. (2010) J Volcanology and Geothermal Research 192, 1–15