

Geophysical response in lithium-brine monitoring, new exploration paradigms and sustainable green lithium.

Ana Curcio^{1,2}

¹Universidad de Buenos Aires, Facultad de Ingeniería, acurcio@fi.uba.ar

²Proingeo SA, acurcio@proingeo.com.ar

SUMMARY

The energy transition drives the energy sector to renewable energy and electrification, being the critical minerals key players in the industrial development map. They comprise rare earth elements and 35 other elements including lithium that holds the ~65% of its world reserves in the so-called lithium triangle located in Argentina-Bolivia-Chile.

The low electrical resistivities, variations in salt concentrations, weak acoustic impedances contrasts, and dynamics of the hydrogeological system, makes brine monitoring a complex geophysical exploratory problem. On the other hand, the exploration and quantification of in situ resources of lithium have been approached from the viewpoint of mining, assuming stationary resources located in the shallow portion of the subsurface whereas the sustainability of water management and brines production mechanisms are currently questioned.

Since 2018, it has been carrying out various feasibility studies, field tests, and analyses of previous acquisitions and has also performed several acquisitions in many salt flats, concluding that full tensor magnetotellurics (full tensor MT), gravity, and ERT are currently the best combination to reach the exploration objectives, which are: (1) the characterization of the salt flat in depth; basement delineation; (2) the definition of the main structures; and (3) the main faults and detection of semifresh water aquifers on the edge of the salt flat that contribute to its recharge and that are key to the water balance of the endorheic basin (i.e., closed basin), which has the resource in solution.

For this purpose, the evaluation of several prospecting methods in different salt flats was executed, concluding that full tensor magnetotellurics, electrical resistivity tomography and gravity comprises a toolkit that fit the objectives set. It will be discussed the weakness and strengthens of different geophysical methods in brines monitoring; new exploration paradigms; future directions of geophysics; and, geothermal lithium and green lithium.

Keywords: Electromagnetics, multiphysics, lithium-brine, static model, exploration frontiers
