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Can the Moho move? An answer from the Andes

S. V. Sobolev and A. Y. Babeyko
GeoForschungsZentrum Potsdam, stephan@gfz-potsdam.de

The Moho moving through the rocks. This was a beauty of the phase model of the Moho, which had fallen down long ago under the pressure of many experimental data and field observations. However, there are some places on the Earth which indeed seem to require the Moho moving through the rocks.

An active magmatic arc in the Southern Andes is located at the same place of the South America margin for more than 200 Myr. During this time it had to generate anormous volume of magmas. Very modest estimates show that the minimum depth of Moho at the arc must be more than 60-70 km. Seismic and seismological observations, however, consistently place the Moho at 40-45 km depth just beneath and around the arc. Where all this magmatic material is going? One possibility is that it flows horizontally at large distance from the arc. This would, however, require extremely thin (50-60 km) lithosphere, which may be the case close to the arc, but is unlikely already 100 km further inland. Moving Moho would be attractive possibility to solve this problem.

We employ a coupled thermo-mechanical numerical modeling technique to study evolution of the crustal structure in the Southern Andes. The model includes the subducting Nazca plate, which generates mafic magmas with certain rate (model parameter). The model also includes the South America plate margin overriding the Nazca plate. The magmatic material generated by the arc is put in lower crust by small portions every model time step. We model evolution of the crustal structure during the100 Myr, calculating also distribution of seismic velocities, using petrophysical modeling technique. The preliminary modelling results suggest that the most plausible scenario for the Southern Andes is accumulation of the mafic magmatic material in the lowermost crust, its transformation into the dense garnet granulite, and periodic avalanches of the dense material into the hot mantle beneath the arc. In this scenario seismic Moho (defined as jump of seismic velocities) can move up and down but at realistic values

of parameters never subsides deeper than 50 km. In this example seismic Moho coincides with chemical boundary between mafic and ultramafic rocks , but nevertheless can move through the rocks.