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3-D density modeling of Mt. Paekdu (N Korea/China) stratovolcano and its evolution by a combination of EGM2008/terrestrial gravity field

Hans-Jürgen Götze and Sungchan Choi

Christian-Albrechts-Universität zu Kiel, Institut für Geowissenschaften, Abt. Geophysik, Geophysik, Kiel, Germany (hajo@geophysik.uni-kiel.de)

We combined the global gravity dataset EGM2008 and a local terrestrial gravity data survey to conduct constrained 3-D crustal density modeling of a strato-volcanic complex and the surrounding area located close to the border of North Korea and China. The independent geophysical (seismic, seismology, geochemistry) and petrological constraints will be presented together with the preprocessing of data base by curvature analysis and Euler deconvolution. The multiple data base is used to assist a general interpretation of the investigated area, and the 3D density model (modelled by the in-house IGMAS+ software). Mt. Paekdu is characterized by a low of Bouguer anomaly of some -110×10^{-5} m/s^2, which is caused by the combined gravity effects of (1) Moho depth of about 40 km, (2) a zone with both lower P-wave velocity and density than the surrounding, (3) low density volcanic rocks at the surface, and (4) the presence of a magma chamber that has not previously been identified.

The terrestrial gravity field measured along the seismic profile shows a remarkable anomaly descending from the southern- to the northern flank of the Mt. Paekdu volcano, which should be a typical anomaly pattern generally observed over the active volcanic area in the world (e.g. the Yellow Stone volcano). The trend is interpreted to be caused by a prominent density difference between a serious of high density mid crustal sill beneath the southern flank and a predicted partial melted zone locating in the northern flank. With the help of several geoscientific observations (seismic, electromagnetic, gravity and geochemistry) and the 3D density model we conclude that a high density sill was formed in Pliocene and early Pleistocene after pre-shield plateau-forming eruption. Since the Pliocene, volcanic activity in the Mt. Paekdu region might be migrated from the southeastern of North Korea to the northwest, following the path of NW–SE-trending faults. Recently observed seismic tremors can be explained by the vertical movement of the partial melted magma chamber beneath the northern part of the Mt. Baekdu volcanic area, which is confirmed by vertical stress change calculation.