Water Concentration Prediction of MORB and BABB by a Machine Learning Approach

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Water is a key component which can change chemical and physical properties of the mantle materials greatly. It's amount and concentration in the mantle are essential to learn mantle dynamics. Mid-ocean ridge basalts (MORB) and back-arc basin basalts (BABB), sampling the depleted upper mantle and the latter including some signals of the subducted slabs, provide abundant information of the upper mantle. In this study, we've collected MORB and BABB glass data with water concentration from all over the world and introduced an approach of multivariate polynomial regression using a machine learning algorithm to estimate water concentration from the abundances of major oxides and some trace element. Coefficient of determination (R^2) and root-mean-square error (RMSE) are applied to evaluate the performance of our model. Recently, the best-performed models show R^2 of 0.822 and a RMSE of 0.181 wt% for the test set. This result shows the feasibility of predicting the water abundance from major and trace element. The proposed model has important implication for our understanding of mantle dynamics, mantle heterogeneity, and crust-mantle water recycling.