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**Prediction of Continental Crust Thickness: Evaluation of Various Machine Learning Algorithms**

Aditya Ray1, Dr. Anirban Chatterjee2

*1Undergraduate Student, Department of Geology, Presidency University, Kolkata, West Bengal 700073, India*

*2Professor , Department of Geology, Presidency University, Kolkata, West Bengal 700073, India*

\*adityaray2204@gmail.com

**ABSTRACT**

Variations in crustal thickness assists in unraveling the evolution of continental crust and geodynamics through time. Past efforts have used rare earth element (REE) ratio proxies, such as La/Yb, Sr/Y, and Ce/Y, as seen in the CRUST 1.0 model, to quantify paleocrustal thickness. However, these proxies often yield results that significantly differ from geophysically constrained thickness, indicating lesser efficiency. In recent times, a shift towards employing Machine Learning(ML) Algorithms have been observed in an effort to develop more efficient models. This paper takes on a similar approach aiming to evaluate the efficiency of four such ML algorithms: Extreme Gradient Boosting(XGBoost), Extremely Randomized Tree(ERT), Random Forest and Artificial Neural Network(ANN). The training dataset of the model includes the major oxide and REE composition of about 1080 felsic to intermediate rocks from arcs and continental orogens across the globe along with geophysically measured crustal thickness. After training and validation, the root-mean-square error (RMSE) and the coefficient of determination (R2) score were used to evaluate the performance of each of the algorithms. Remarkably, all the algorithms outperform the conventional REE ratio proxies. The XGBoost model provides better efficiency compared to previously proposed models. The validity of the models are further demonstrated when applied on Kohistan-Ladakh Arc and Gangdese Arc. The utilization of efficient Machine Learning Algorithms emerges as a sustainable and resource-efficient method to quantify not only crustal thickness but also other paleoenvironmental features.

KEYWORDS

Crustal Thickness, Machine Learning, Geochemical Database, India-Asia Collision