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Late Paleoproterozoic Paleogeography of Baltica and Laurentia: New Paleomagnetic Data from 1.80–1.75 Ga Mafic Intrusions of Fennoscandia and Sarmatia

Natalia V. LUBNINA[1], Sergei A. PISAREVSKY[2], Svetlana V. BOGDANOVA[3] and Svetoslav J. SOKOLOV[4]

1 Faculty of Geology, M.V. Lomonosov Moscow State University, Moscow, 119991, Russia;
2 Australian Research Council Centre of Excellence for Core to Crust Fluid Systems (CCFS), Australia; The Institute for Geoscience Research (TIGeR), Department of Applied Geology, Curtin University, GPO Box U1987, Perth, WA 6845, Australia;
3 Department of Geology/Lithosphere and Paleobiosphere, University of Lund, Solvegatan 12, SE22363, Lund, Sweden;
4 Institute of Geology of Karelian Scientific Centre, Pushkinskaya st., 11, Petrozavodsk, 185910, Russia

Tectonic evolution and paleogeography of the two major continental blocks Fennoscandia and Volgo-Sarmatia during their docking to form the East European Craton (Baltica) at 1.8–1.7 Ga represent important 'puzzle pieces' in global Precambrian paleogeography. A series of recently dated 1.78–1.75 Ga lamprophyre and shoshonite intrusions are exposed north of Ladoga Lake in southern Karelia (Fennoscandia). We carried out a paleomagnetic study of these intrusions and an additional study of the coeval gabbro-dolerite Ropruchey sill near the Onega Lake. All studied rocks carry a stable primary remanence supported by positive contact tests. We also studied 14 mafic dykes and 1 mafic sill related to the large 1.80–1.75 Ga anorthosite-rapakivi granite (AMCG) plutons in the Ukrainian Shield (Volgo-Sarmatia). Most of these intrusions have been dated or re-dated recently by U-Pb (baddeleyite) method at 1.80–1.75 Ga. Ukrainian dykes also carry a consistent stable bipolar remanence. Two positive contact tests suggest that this remanence is primary. In the Ukrainian Shield we describe the relationships of the mafic dyking with strike-slip faulting during two phases of transtension. NE–SW extension dominated the first one between 1.80 and 1.77 Ga, while E -W extension at 1.76–1.75 Ga. It suggests 45 degrees anticlockwise rotation of the principal stresses. A comparison of new and previously published paleomagnetic data shows a significant difference between Fennoscandian and Sarmatian 1.80–1.75 Ga paleopoles. This implies that the final assemble of Baltica by docking of Volgo-Sarmatia and Fennoscandia occurred after 1.75 Ga. Consequently these two parts of Baltica should be considered as independent blocks in pre-1.75 Ga paleogeographic reconstructions. Paleomagnetic reconstructions, which employ the c. 1.77 and 1.75 Ga pair of key poles of Laurentia, Fennoscandia and Volgo-Sarmatia, and the 1.45 Ga pole for Laurentia and Baltica, agree with the kinematic characteristics and confirm shifting rotations of Volgo-Sarmatia during its protracted oblique docking with Fennoscandia and Laurentia as supercontinent Columbia (Nuna) was assembled. Simultaneously, convergent tectonics and magmatism characterized the Laurentia–Fennoscandia common continental margin, indicating continuing assembly of the Columbia (Nuna) supercontinent in the Statherian.

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* Corresponding author. E-mail: natalia.lubnina@gmail.com