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Map of Mafic Dyke Swarms and Related Units of Russia and Adjacent Regions

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Work is currently underway to produce a map in ArcGISTM 10 of the mafic dyke swarms and related units (volcanics, sills and layered intrusions) of Russia and adjacent regions at a scale of 1:5,000,000. Over the past three years dykes have been traced from georeferenced source maps, including the 1:1,000,000 series of geological maps (courtesy of VSEGEI, St. Petersburg, Russia) and numerous regional and local maps from journal publications. Dykes are being grouped into swarms based on their distribution, trend and geochronology. This work compliments broad-scale mapping of dyke swarms (and related units) in other regions such as Canada and adjacent areas (Buchan and Ernst 2004, 2013), Finland (Vuollo and Huhma 2005) and northern China (Peng, 2015).

The new map of Russia and adjacent regions will be helpful in linking dyke swarms of similar age or similar trend in different local areas. In turn, this information can be used to determine the areal extent and overall geometry of giant dyke swarms. Giant radiating dyke swarms are of particular interest. Their foci locate probable mantle plume centres, which are often linked to continent or supercontinent breakup. Large dyke swarms are typically feeder systems for volcanic rocks, sills and layered intrusions associated with large magmatic events such as Large Igneous Provinces (LIPs).

The map will also be useful for testing global reconstructions, by facilitating comparison of giant dyke swarm trends and ages between cratonic blocks. Finally, it will be helpful in targeting dykes for precise U-Pb dating, paleomagnetism, geochemistry, and additional mapping.

Approximately 100 relatively large swarms have been identified to date with lengths up to 1200 km.

Of particular note are several giant radiating swarms. For example, the giant radiating swarm associated with the 250

Ma Siberian Trap LIP has subswarms which can be traced for >750 km over an arc of 100°. Taken together with related volcanic rocks and sills, including those beneath the West Siberian Basin, the overall event extends over ~6 million sq km. The 370 Ma Yakutsk-Vilyui LIP of Siberia is dominated by a giant radiating dyke swarm, with subswarms that can be traced for up to 900 km over an arc of 140°. These subswarms and associated volcanic rocks are located along arms of a prominent radiating rift system. The 1750 Ma Tipton giant radiating dyke swarm of Siberia exhibits three subswarms that extend out to a distance of 1200 km from the focal point over an arc of 200°. Additional dykes in the Aldan Shield, of less certain age, trend towards the Tipton focus, and hence may fill in the radiating pattern between the subswarms.

Several giant linear swarms have been catalogued. For example, the 400 km long 1870 Ma Kalaro-Nimnyrsky swarm of the Aldan Shield is approximately coeval and colinear with the major 150 m wide Malozadoisky dyke in basement rocks exposed in the western Irkutsk promontory. Together they may represent a giant swarm that is 1500 km in length. Large linear swarms are also commonly observed intruding Phanerozoic rocks. For instance, a N-S trending Devonian swarm extends 1200 km along the Ural Mountains. A dense 600 km long NE-trending Jurassic/Cretaceous swarm cuts the Verkhoyansk belt.

Some swarms are thought to be components of giant radiating or linear swarms and associated LIPs that extend outside the current map area or are located on other continental blocks as a result of continental break up and drift. For example, the ca. 2100 Ma Karelian dyke swarm of western Russian can be traced into Finland, and in a continental reconstruction has been linked to the coeval Marathon dyke swarm of the Superior craton of North America. The dykes of Franz Josef Land are linked to the 130-80 Ma High Arctic Large Igneous

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Province (HALIP), whose dykes extend across Svalbard, northern Greenland and the Arctic islands of northern Canada. Radiating dykes of the ca. 725 Ma Irkutsk swarm are likely linked via a continental reconstruction to coeval dykes of the Franklin giant radiating dyke swarm in northern Canada. In addition, the 370 Ma Yakutsk-Vilyui swarm, discussed earlier, likely extends onto another continental block, given that its focus is located on the eastern rifted margin of the Siberian craton.

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