МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РОССИЙСКОЙ ФЕДЕРАЦИИ
НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

ПРАВИТЕЛЬСТВО РОССИЙСКОЙ ФЕДЕРАЦИИ

РОССИЙСКИЙ ФОНД ФУНДАМЕНТАЛЬНЫХ ИССЛЕДОВАНИЙ

Национальный исследовательский Томский государственный университет

25 ЛЕТ РФФИ

Петрология магматических и метаморфических комплексов

Выпуск 9

Материалы IX Всероссийской конференции
с международным участием

28 ноября – 2 декабря 2017 года

Томск 2017

SEMI-AUTOMATIC EXTRACTION AND MAPPING OF DYKE SWARMS BASED ON MULTI-RESOLUTION REMOTE SENSING IMAGES: APPLIED TO THE KULUKTAGE BLOCK IN THE NORTHEASTERN TARIM CRATON

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Abstract: Here we present an efficient method to map mafic dyke swarms semi-automatically by using multi-resolution remote sensing images. This method is applied in the Kuluketage block in the northeastern Tarim craton, northwest China, where mafic dykes of likely Neoproterozoic are widely exposed. The tracing of dykes, including their orientation, length, thickness, density, and distribution is done by integrating 30-m multispectral Landsat 8 and 2-m panchromatic CORONA KH-4B imagery. The Gramm–Schmidt Spectral Sharpening approach is used to generate color composite and fusion images with 2-m resolution. The Canny edge detector and Hough transform are used to detect dyke edges. Combining the detection of dyke edges with ArcGIS™, the dyke orientation, length, density, thickness, and exposed area are measured. The accuracy of the semi-automatic method exceeds 75% in comparison with manual mapping of the dykes. More than 80% of the dykes were intruded into Proterozoic granites, and the main dyke orientation is NW-SE (300°-320°), but additional trends are present which likely represent additional swarms. For the main swarm the distribution of measured dyke lengths and thicknesses are best fit by a negative exponent distribution based on the estimated coefficients of determinations. The depth of an underlying magma chamber is estimated at <33 km based on the assumption that the dykes are vertically emplaced. Alternatively, the source area for the swarm is located beyond the NW or SE ends of the swarm based on a lateral dyke injection model.