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Integrating Landsat 8 and Corona KH-4B Imagery to Semi-Automatically Extract Dyke Geometries in Kuluktag Region, Xinjiang

NI Nina^{*}, CHEN Ninghua and YANG Shufeng

Department of Earth Sciences, Zhejiang University, Hangzhou 310027, China

Dyke swarms are widely distributed in Kuluktag region of Xinjiang, Northwest China. These dyke geometries indicate the process of the magma emplacement as well as the geological setting when the dykes intruded. Remotely sensed data have been proved to be effective for mapping the geometries of dyke swarms in remote and arid areas. High-resolution satellite imagery provides the possibility to measure detailed dyke geometries, such as their exposed thickness and cross-cutting relationship. Unfortunately, manual extraction of dyke geometries on a large scale based on high-resolution imagery is usually time- and cost- consuming. In this paper, we present an efficient and economical method to extract dyke geometries semi-automatically by integrating 30-m multispectral Landsat 8 and 2-m panchromatic Corona KH-4B imagery. Color composite and fusion images with 2-m resolution were generated by using the Gram–Schmidt Spectral Sharpening approach, which enhances the linear characteristics of dykes and provides the ability to measure the orientation, exposed length, thickness, and area of dykes. Canny algorithm and Hough transform were used to detect dyke edges, then the dyke orientation and length could be measured by using the Spatial Analyst and

Spatial Statistics tools in the ArcGIS software. The exposed thickness and area of dykes can be calculated by using the pixels on the binary image of dyke segmentation, benefiting from the high resolution of fusion images. The results show that integrating Landsat 8 and Corona KH-4B imagery improves the accuracy and efficiency in determining dyke geometries. The semi-automatic method can extract more than 85% of dykes in the areas with well diacritical dykes. However, the dykes intruded into dark rocks are difficult to be distinguished and extracted automatically, therefore, the manual measurement was complemented. Combing automatic and manual extraction, 2345 dykes were measured in Kuluktag. The NW-trending (300° - 320°) dykes are dominated, followed by the NE (40° - 70°) and some nearly EW-trending dykes. The obvious cross-cutting relationships of the NW-trending dykes crossing the NE-trending dykes indicate that there are at least two-period dykes. The dyke thicknesses and lengths are both reasonably close to following logarithmic normal distributions. The area of exposed dykes in Kuluktag region approximates to 161 km^2 in the study region of 5200 km^2 .

^{*} Corresponding author. E-mail: geo316@zju.edu.cn