LUAN Jinpeng, XU Wenliang, WANG Feng, WANG Zhiwei and GUO Peng, 2017. Age and geochemistry of the Neoproterozoic granitoids in the the Songnen–Zhangguangcai Range Massif, NE China: Petrogenesis and tectonic implications. *Acta Geologica Sinica* (English Edition), 91(supp. 1): 185-186.

Age and geochemistry of the Neoproterozoic granitoids in the the Songnen–Zhangguangcai Range Massif, NE China: Petrogenesis and tectonic implications

LUAN Jinpeng, XU Wenliang*, WANG Feng, WANG Zhiwei and GUO Peng

College of Earth Sciences, Jilin University, Changchun 130061, China

1 Introduction

The Songnen–Zhangguangcai Range Massif (SZRM) crops out over an extensive part of NE China and was thought to contain Precambrian crystalline basement material, as evidenced by the presence of what appears to be Paleoproterozoic basement material within exploration drillholes (Pei et al., 2007). An alternative view is that the basement within the SZRM is predominantly Phanerozoic, as evidenced by the presence of Paleozoic fossils and comparatively rare geochronological data (Guo and Liu, 1985; Wu et al., 2011), meaning that the Precambrian rocks in this area may be a tectonically emplaced slice of the North China Craton (Pei et al., 2007; Zhang et al., 2005). In addition, the Zhangguangcailing Group was previously thought to represent the Neoproterozoic basement of the SZRM but actually formed between the early Paleozoic and early Mesozoic (Wang et al., 2012). All of this means that the age and nature of the SZRM basement, and whether this area records Neoproterozoic magmatism, remain unclear. In addition, the fact that the Neoproterozoic is a key period of geological time in Earth's history that recorded the assembly and dispersal of Rodinia means that determining whether Neoproterozoic rocks are actually present in the SZRM is an important step in furthering our understanding of the early stages of the tectonic evolution of the SZRM (Cawood et al., 2010).

This study presents new geochronological, whole-rock geochemical, and zircon Hf isotopic data for early Neoproterozoic granitoids within the eastern margin of the SZRM of NE China. These data provide insights into the Neoproterozoic tectonic setting of the SZRM and the links between this magmatism and the evolution of the Rodinia supercontinent.

* Corresponding author. E-mail: xuwl@jlu.edu.cn

2 Results and Discussion

The zircon U–Pb dating indicates that the Neoproterozoic magmatism within the SZRM can be subdivided into two stages: (1) a ~917–911 Ma suite of syenogranites and monzogranites, and (2) an ~841 Ma suite of granodiorites (Fig. 1).

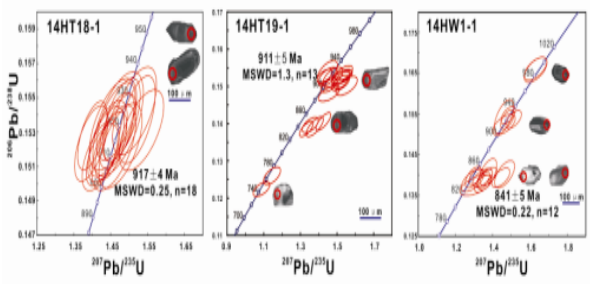

Fig. 1. Zircon U–Pb concordia diagrams for the Neoproterozoic granitoids examined in the SZRM

The 917–911 Ma granitoids contain high concentrations of SiO_2 (67.89–71.18 wt.%), K_2O (4.24–6.91 wt.%), and Al_2O_3 (14.89–16.14 wt.%), and low concentrations of TFe_2O_3 (1.63–3.70 wt.%) and MgO (0.53–0.88 wt.%). They are enriched in the light rare earth elements (LREE) and the light ion lithophile elements (LILE), are depleted in the heavy REE (HREE) and the heavy field strength elements (HFSE; e.g., Nb, Ta, and Ti), and have slightly positive Eu anomalies (Fig. 2),

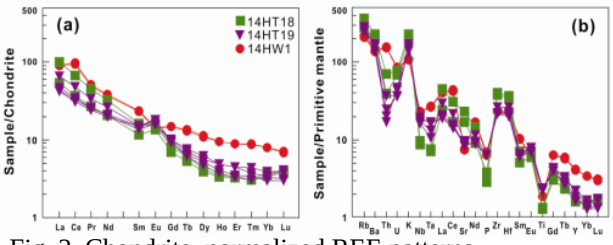

Fig. 2. Chondrite–normalized REE patterns (a) and primitive mantle normalized trace element (b) diagram for the Neoproterozoic granitoids within SZRM.

indicating they are geochemically similar to high-K adakitic rocks. They have zircon $\varepsilon_{Hf}(t)$ values and T_{DM2} ages from –4.4 to +1.5 and from 1915 Ma to 1592 Ma (Fig. 3), respectively, suggesting they were derived from a primary magma generated by the partial melting of ancient thickened lower crustal material. In comparison, the 841 Ma granodiorites contain relatively low concentrations of Al_2O_3 (14.50–14.58 wt.%) and K_2O (3.27–3.29 wt.%), relatively high concentrations of TFe_2O_3 (3.78–3.81 wt.%) and the HREE, have negative Eu anomalies (Fig. 2), and have zircon $\varepsilon_{Hf}(t)$ values and T_{DM2} ages from –4.7 to +1.0 and from 1875 to 1559 Ma, respectively (Fig. 3).

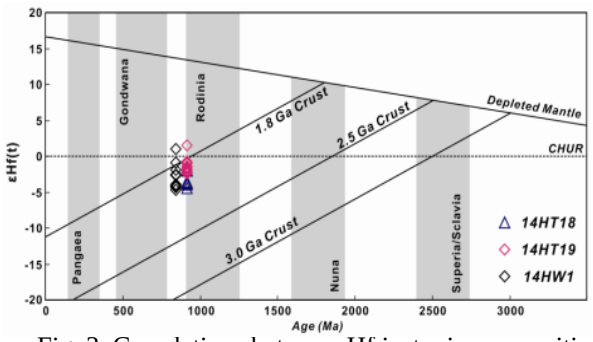

Fig. 3. Correlations between Hf isotopic compositions and ages of zircons from the Neoproterozoic granitoids.

These granodiorites formed from a primary magma generated by the partial melting of ancient crustal material. The ~917–911 Ma magmatism within the SZRM is inferred to have formed in an orogenic setting, whereas the ~841 Ma magmatism formed in an anorogenic setting related to either a post-orogenic tectonic event or the onset of Neoproterozoic continental rifting. It is proposed that the microcontinental massifs within the SZRM formed during or following the final stage of assembly of Rodinia before rifting away from the Tarim Craton in response to Rodinia breakup.

Acknowledgements

We thank the staff of Institute of Geology and Geophysics, Chinese Academy of Sciences for their advice and assistance during U-Pb zircon dating using LA-ICP-MS/SIMS. This work was financially supported by the National Natural Science Foundation of China (Grants 41330206) and National Key Basic Research Program of China (2013CB429803).

References

Cawood, P.A., Strachan, R., Cutts, K., Kinny, P.D., Hand, M., Pisarevsky, S., 2010. *Neoproterozoic orogeny along the margin of Rodinia: Valhalla orogen, North Atlantic*. Geology 38, 99–102.

Guo, C.K., Liu, J., 1985. *Basement and cover features of Songliao Basin.* In: Contributions to Structural Geology, Editional Board of Contributions to Structural Geology, vol. 4 (in Chinese). Geological Publishing House, Beijing, pp. 133–139.

Pei, F.P., Xu, W.L., Yang, D.B., Zhao, Q.G., Liu, X.M., Hu, Z.C., 2007. *Zircon U–Pb geochronology of basement metamorphic rocks in the Songliao Basin.* Chinese Science Bulletin 52, 942–948.

Wang, F., Xu, W.L., Gao, F.H., Meng, E., Cao, H.H., Zhao, L., Yang, Y., 2012. *Tectonic history of the Zhangguangcailing Group in eastern Heilongjiang Province, NE China: constraints from U–Pb geochronology of detrital and magmatic zircons.* Tectonophysics 566–567, 105–122.

Wu, F.Y., Sun, D.Y., Ge, W.C., Zhang, Y.B., Grant, M.L., Wilde, S.A., Jahn, B.M., 2011. *Geochronology of the Phanerozoic granitoids in northeastern China*. J. Asian Earth Sciences 41, 1–30.

Zhang, Y.B., Wu, F.Y., Zhai, M.G., Lu, X.P., 2005. *Tectonic Setting of the Helong Block: implications for the northern boundary of the eastern North China Craton*. Science in China (D) 48, 1599–1612.