Петрология магматических и метаморфических комплексов

Материалы Всероссийской конференции с международным участием

Выпуск 9

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

УДК 551.24
ББК 26.303

Петрология магматических и метаморфических коплексов. Вып. 9. Материалы IX Всероссийской петрографической конференции с международным участием. – Томск: Изд-во Томского ЦНТИ. 2017. – 475 с.

В сборнике представлены материалы 9-й научной конференции по проблемам генезиса, моделирования условий формирования, структурной организации и минерагении магматических и метаморфических комплексов. Рассмотрены вопросы их геохронологической корреляции и формационной типизации.

Для специалистов в области петрографии, геологической съемки и прогноза месторождений полезных ископаемых.

Технические редакторы – Гертнер И.Ф., Дугарова Н.А.
Оригинал-макет – А. Бакшаева

Кафедра петрографии Томского государственного университета

Petrology of magmatic and metamorphic complexes. Issue 9 Pceeding of science meeting. – Tomsk: Tomsk CSTI Publishing house. 2017. – 475 p.

The collection includes reports from the 9th science meeting according petrology of magmatic a metamorphic rocks and their metallogeny and structural construction. Questions of their correlation and formation type are discussed.

The book is interesting for specialists in the field of petrography and geological survey and proposal of ore deposits.

Tecknical editors – I.F. Gertner, N.A. Dugarova.
Original design – A. Bakshaeva

Petrography department of Tomsk State University

ISBN 978-5-89702-432-2

Издательство Томского ЦНТИ. Бумага офсетная № 1. Печать офсетная.
Подписано в печать 22.11.2017 г. Заказ № 998. Тираж 110 экз.
Отпечатано в Томском ЦНТИ.
Россия, 634021, г. Томск, пр.Фрунзе, 115/3. Тел. (8-3822) 26-31-69

СОДЕРЖАНИЕ

PALEORECONSTRUCTIONS OF WYOMING AND SUPERIOR CRATONS FROM 2.70 TO 1.72 GA WITH IMPLICATIONS FOR ARCHEAN-PROTEROZOIC SUPERCONTINENTS AND THE CIRCA 2.45-2.35 GA GREAT OXIDATION EVENT

Chamberlain, Kevin, *Univ. of Wyoming, USA & Tomsk State Univ.*
Kilian, Taylor, *Univ. of California-Berkeley, USA*
Bleeker, Wouter, *Geologic Survey of Canada, Ottawa, Canada*
Evans, David, *Yale University, USA*
Ernst, Richard, *Carleton University, Canada & Tomsk State Univ.*
Bekker, Andrey, *Univ. of California-Riverside, USA*

The ages and orientations of mafic dykes can be effective tools for testing pre-Pangea continental reconstructions (Bleeker and Ernst, 2006), especially when combined with paleomagnetic data. This paper presents new U-Pb geochronologic data and paleomagnetic measurements relating to the Archean to Proterozoic sojourns of the Wyoming and Superior cratons. These cratons formed the core of a much larger supercratonic assembly that existed for nearly 500 Ma and may have included most of the cratonic blocks of the Earth at that time.

Direct U-Pb dating of deformation coupled to paleomagnetic data from Archean and Proterozoic dyke swarms has established that southern Wyoming and southern Superior cratons sutured ca. 2.65 Ga along the Oregon Trail structural belt (OTSB) in central Wyoming and remained connected until ca. 2.1 Ga rifting (Chamberlain et al., 2003; Grace et al., 2006; Frost et al., 2006; Kilian 2015; Kilian et al., 2016a). Wyoming was likely part of a much larger, high-μ ($^{238}U/^{204}Pb$) craton, and this collision was a key step in formation of the supercraton Superia-Vaalbara, which included Kola-Karelia. Superia-Vaalbara migrated to the equator by 2.45 Ga, and was intruded by a series of Large Igneous Provinces, which contributed to several Paleoproterozoic glaciations (Snowballs Earth-style) and oscillations in the atmospheric redox state at the early stage of the Great Oxidation Event between 2.43 and 2.32 Ga (Gumsley et al., 2017).

In this reconstruction, the Huronian Supergroup, deposited along the southern margin of the Superior craton, and the lower part of the Snowy Pass Supergroup, deposited along the southeastern margin of the Wyoming craton, are coeval successions from the conjugate sides of the failed rift. Breakup of Superia-Vaalbara involved multiple rifting events from 2.3 to 2.0 Ga and possibly led to the first separation of the high-μ cratons: Pilbara, Kaapvaal, Wyoming, Hearne, and Kola-Karelia. Separation of Wyoming and Superior occurred ~100 km south of the OTSB suture, leaving the Archean Southern Accreted terrane (SAT) attached to the Wyoming craton. The SAT has geological, geophysical and isotopic affinity with the Superior craton. By 1.90 Ga, Wyoming and Superior cratons were ~60° apart in longitude at mid-latitudes on the basis of the simplest drift paths and data from the Sourdough dike swarm (Kilian et al., 2016b). The Wyoming craton joined Laurentia by reconnecting with the Superior craton along the Wyoming craton's eastern margin ca. 1.72 Ga based on tectonic evolution of the Hartville Uplift, in SE Wyoming (Krugh 1997) and Black Hills, in South Dakota (Allard and Portis, 2013).

While Kola-Karelia forms part of the Superia-Vaalbara reconstruction, it is unclear whether or not the Anabar and Aldan shields were connected to this early Proterozoic supercraton, although Paleoproterozoic successions recording the ca. 2.2 Ga Lomagundi carbon isotope excursions were deposited along open margins of both shields. There is good evidence that the Siberian craton was near the northern margin of Superior province from 1.75 to 0.75 Ga (Ernst et al., 2016), but any earlier paleoreconstructions of the Siberian craton are less certain.

References:

1. Allard, S.T. and Portis, D.H., 2013. Paleoproterozoic transpressional shear zone, eastern Black Hills, South Dakota: Implications for the late tectonic history of the southern Trans-Hudson Orogen. Rocky Mountain Geology, 48(2), pp.73-99.
2. Bleeker, W. and Ernst, R., 2006. Short-lived mantle generated magmatic events and their dyke swarms: the key unlocking Earth's paleogeographic record back to 2.6 Ga. Dyke swarms—time markers of crustal evolution, pp.3-26.
3. Chamberlain, K.R., Frost, C.D., and Frost, B.R., 2003, Early Archean to Mesoproterozoic evolution of the Wyoming Province: Archean origins to modern lithospheric architecture: Canadian Journal of Earth Sciences, v. 40, p. 1357-1374
4. Ernst, R.E., Hamilton, M.A., Söderlund, U., Hanes, J.A., Gladkochub, D.P., Okrugin, A.V., Kolotilina, T., Mekhonoshin, A.S., Bleeker, W., LeCheminant, A.N., Buchan, K.L., Chamberlain, K.R., Didenko, A.N., 2016, Long-lived connection between southern Siberia and northern Laurentia in the Proterozoic. Nature Geosciences. DOI: 10.1038/NGEO2700 v. 9, p. 464-469.
5. Frost, C.D., Fruchey, B.L., Chamberlain, K.R., and Frost, B.R., 2006, Archean crustal growth by lateral accretion of juvenile supracrustal belts in the south-central Wyoming province. Canadian Journal of Earth Sciences, v. 43, no. 10, p. 1533-1555. Doi: 10.1139/E06-092.
6. Grace, Rashmi L.B., Chamberlain, Kevin R., Frost, B. Ronald, and Frost, Carol D., 2006, Tectonic histories of the Paleo- to Mesoarchean Sacawee Block and Neoarchean Oregon Trail structural belt of the south-central Wyoming province. Canadian Journal of Earth Sciences, v. 43, no. 10, p. 1445-1466. doi: 10.1139/E06-083.
7. Gumsley, A.P., Chamberlain, K.R., Bleeker, W., Söderlund, U., de Kock, M.O., Larsson, E.R., Bekker, A., 2017, Timing and tempo of the Great Oxidation Event. Proceedings of the Academy of Sciences. doi/10.1073/pnas.1608824114.
8. Kilian, T.M., 2015, Precambrian paleomagnetism of mafic dike swarms and the Wyoming craton: Implications for an Archean supercontinent [Ph.D. Thesis]: Yale University, 329 p.
9. Kilian, T. M., Bleeker, W., Chamberlain, K., Evans, D. A., & Cousens, B. (2016a). Palaeomagnetism, geochronology and geochemistry of the Palaeoproterozoic Rabbit Creek and Powder River dyke swarms: implications for Wyoming in supercraton Superia. in "Supercontinent Cycles Through Earth History" Geological Society, London, Special Publications, 424(1), 15-45. doi.org/10.1144/SP424.7
10. Kilian, T. M., Chamberlain, K. R., Evans, D. A., Bleeker, W., & Cousens, B. L. (2016b). Wyoming on the run—Toward final Paleoproterozoic assembly of Laurentia. Geology, 44(10), 863-866. doi:10.1130/G38042.1
11. Krugh, K.A., 1997, Uranium-lead thermochronologic constraints on the early Proterozoic tectonic evolution of the Hartville Uplift, southeast Wyoming [EP20251 M.S.]: University of Wyoming, 77 p.