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LARGE IGNEOUS PROVINCES THROUGH EARTH HISTORY: MANTLE PLUMES, SUPERCONTINENTS, CLIMATE CHANGE, METALLOGENY AND OIL-GAS, PLANETARY ANALOGUES (LIP – 2019)

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КРУПНЫЕ ИЗВЕРЖЕННЫЕ ПРОВИНЦИИ В ИСТОРИИ ЗЕМЛИ: МАНТИЙНЫЕ ПЛЮМЫ, СУПЕРКОНТИНЕНТЫ, КЛИМАТИЧЕСКИЕ ИЗМЕНЕНИЯ, МЕТАЛЛОГЕНИЯ, ФОРМИРОВАНИЕ НЕФТИ И ГАЗА, ПЛАНЕТЫ ЗЕМНОЙ ГРУППЫ (КИП – 2019)

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DEVONIAN BIOTIC CRISES AND LINKS TO LIPS

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Large Igneous Provinces (LIPs) are emerging as a significant driver of short duration climatic change including mass extinctions (e.g., Bond and Grasby, 2017; Ernst and Youbi 2017). We compare the record of LIPs against the timing of Devonian (and end-Silurian) biotic crises that are recorded in the numerous anoxia events throughout this period (Figs. 1, 2). The largest LIPs are two-pulse events at ca. 370 and ca. 360 Ma that are present in both Siberia (Yakutsk-Vilyui LIP) and Baltica (Kola-Dnieper LIP) and correlate with the Kellwasser anoxia events (end Frasnian) and Annulata or Dasber and Hangernberg anoxia events in the middle/late Famennian. The regionally significant Altai Sayan LIP is only approximately dated at c. 400 Ma and within uncertainties could be linked to either (or both?) the c. 405 Ma Chebbi or Atopus anoxia events near the basal Emsian (associated with graptolite extinction) or the c. 385-390 Ma group of anoxia events in the Eifelian or Givetian.

Additional magmatic events that are less precisely dated are: 1) the c. 0.45-.41 "Overstep volcanic-sedimentary events and 0.38–0.33 Maritimes (Magdalen) basin event of the Appalachian region of eastern Canada and adjacent US, 2) lower Devonian Selwyn basin alkaline magmatism of northwestern Canada, and 3) the Ordovician - late Silurian Soltan Maidan event and younger Devonian volcanics pulses of Iran. However, more precise dating is required for each of these before they can be usefully compared with the Devonian (late Silurian) biotic crisis record.

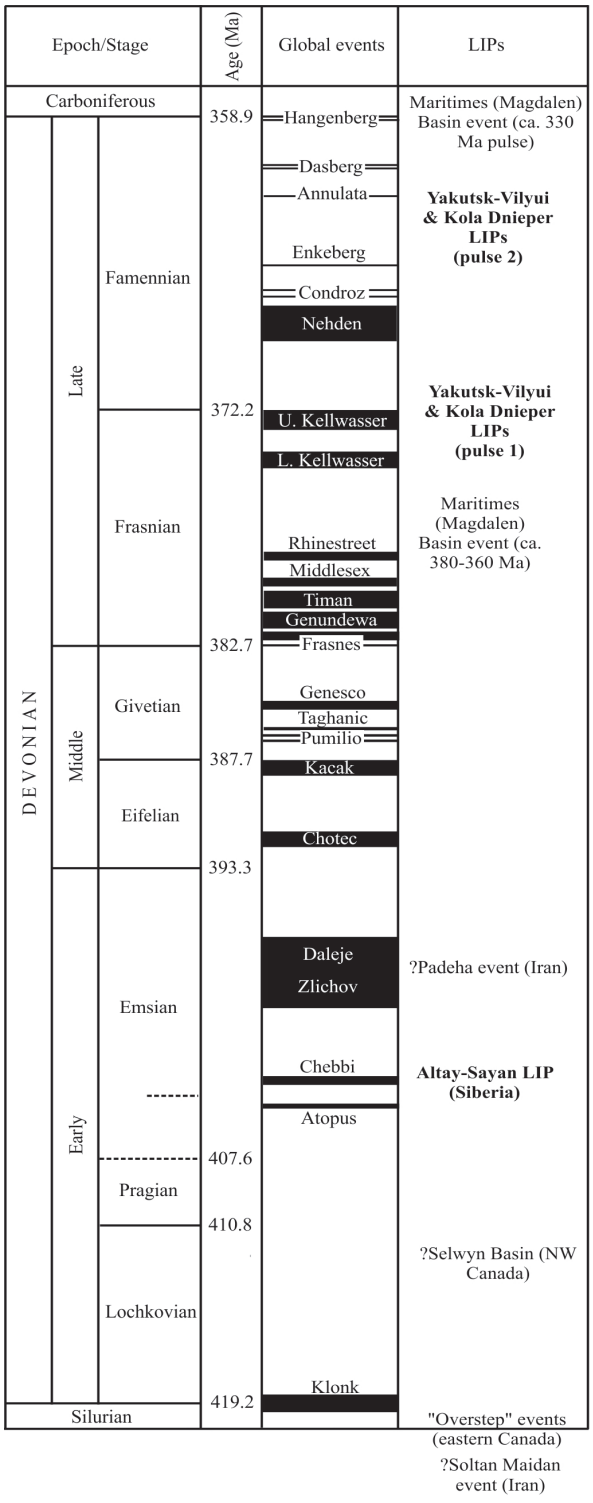

Figure 1. Potential correlations of Devonian (late Silurian) LIPs with black shale events and other biotitic crises. See text and Ernst et al. (2019) for more details.

Acknowledgements

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References

1. Bond, D.P.G., Grasby, S.E. (2017). On the causes of mass extinctions. Palaeogeography, Palaeoclimatology, Palaeoecology, v. 478, p. 3–29.
2. Ernst, R.E., Youbi, N. (2017). How Large Igneous Provinces affect global climate, sometimes cause mass extinctions, and represent natural markers in the geological record. Palaeogeography, Palaeoclimatology, Palaeoecology, v. 478, p. 30-52.
3. Ernst, R.E., Rodygin, S.A., Grinev, O.M. (2019) Large Igneous Provinces as probable trigger of Devonian biotic crises. Global and Planetary Change (in review)

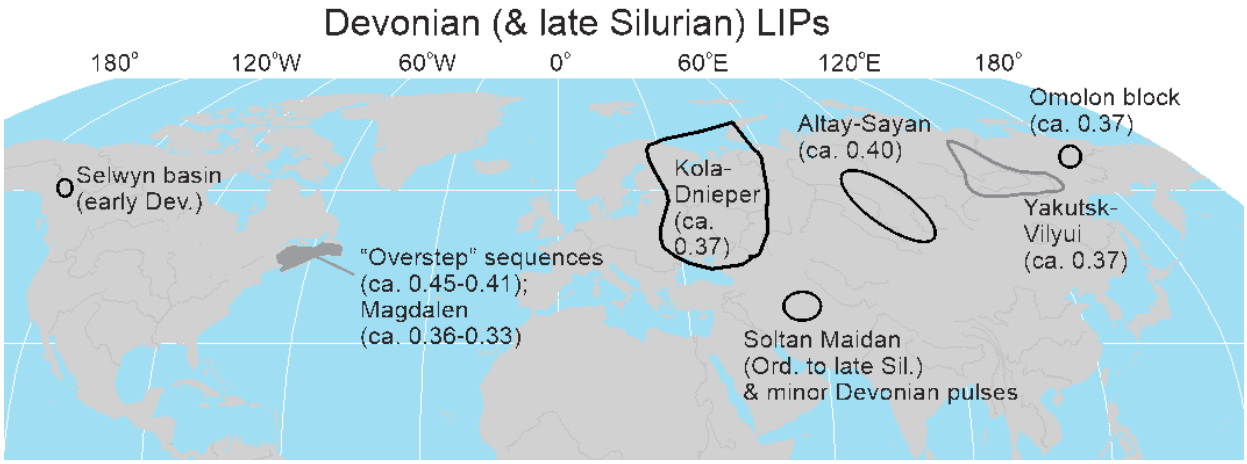

Figure 2: Distribution of LIPs and other important intraplate magmatism of Devonian (and late Silurian) age discussed in this abstract. After Ernst et al. 2019.

EARLY-MIDDLE DEVONIAN KAZAKHSTAN-ALTAI-SAYAN IGNEOUS PROVINCE: FACIES AND TECTONIC ASPECTS

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Keyword: *MIP, mafic sillogenesis, rheological breccia*

Introduction

Large igneous provinces of basic composition emplaced on the continental and/or oceanic platforms are subdivided into two facies types: effusive and dike (Ernst, 2014). The dike-sill type is proposed to distinguish within the mobile (orogenic) belts. (Fedoseev, 2003). In the middle part of the Central Asian orogenic belt it is mapped on a vast territory that can be called as Kazakhstan-Altai-Sayan igneous province (KASIP). It covers an area from the southern spurs of the Urals to the southwestern margin of the Siberian platform extending for about 2000 km with an average width of about 450 km (Fig. 1). However, actually by the total volume of mafic magma including preceding products of pyroclastic volcanism of acid and intermediate composition, it does not conform to the classical LIPs and therefore it can be considered as a medium-scale province (KASMIP).

Results

According to the present concept, the KASMIP is a junction area of active continental margins of the Kazakhstan and Siberian paleocontinents. Evolving in the mode of a young platform, this area changed into a rift-like area. Therefore, the volcanogenic-sedimentary formations of the platform cover including mafic sills were fragmented into numerous blocks. The amount of mafic bodies in different formations varies widely. The total thickness of basalt-dolerite bodies in individual blocks vary widely and can frequently reach several tens of meters. On generally, this is in agreement with the hypothesis of the feasible existence of one or more sedimentary basins whose depocenters are preserved as the Minusa, Kuznetsk, Tuva, Agul, and other troughs (Krasnov et al., 2018).

The obtained new geological data are in contradiction with the traditional concept of the facies nature of mafic bedded bodies and the time of their formation. It turns out that they occur in KASMIP as sills (hypabyssal facies) rather than effusive flows and sheets (surface facies). It is not surprising, then, that the resumed discussion on the correct recognition of the effusive paleo flows and shallow sills are very timely (Makarenko, Kotel'nikov, 2018) The Minusa trough is undoubtedly a worthy area for its constructive development under the "field" conditions, a visit to which is provided for both excursions. This problem is actual when performing geological surveying works, which inevitably stimulates the development of internally consistent set of convergent, divergent and conditionally divergent (false valid) features for identifying the facies of the mapped mafic rocks. Two examples of divergent features of shallow sills are shown hereafter (Fig. 2).

The tectonic factor is of paramount importance among the cause and effect relationships when modeling the process of sill formation ("sillogenesis" in a broad sense). At the moment, there are three versions of the trigger mechanism of sillogenesis: a) undercompensation periods of the downwarping of the Earth's crust (after G.S. Fedoseev), b) decompression of dilatancy faults (after S.Yu. Kolodyazhnyi), c) intersection of the «basement/cover» border by the geochord (after M.G. Leonov), which were proposed in 2006, 2011, and 2013, respectively.