The way to destroy thick cratonic lithosphere

STEPHAN V. SOBOLEV [1]* AND ALEXANDER V. SOBOLEV[2,3]

[1]GFZ, Geodynamic Modelling, Potsdam, Germany, stephan@gfz-potsdam.de (* presenting author)
[2]University J. Fourier, ISTerre, Grenoble, France, alexander.sobolev@ugf-grenoble.fr
[3] Vernadsky Inst. of Geochemistry, RAS, Moscow, Russia

Thick and chemically distinct cratonic lithosphere is known to be tectonically stable. However there are natural examples when large areas of such lithosphere are flooded by huge volumes of basalts comprising Large Igneous Provinces (LIPs). The examples of LIPs that were at least partially extruded at Archean or Proterozoic lithosphere since 250 Ma are numerous, i.e. Siberian Traps, Central Atlantic Province, Karoo, Parana, North-Atlantic Province etc. The outstanding example of the older (2 Ga) LIP is Bushveld Complex located at Archean craton. Thinning of lithosphere is required by any model of origin of such LIPs because only when the source ascends to shallow level can normal mantle peridotite produce a large amount of melt.

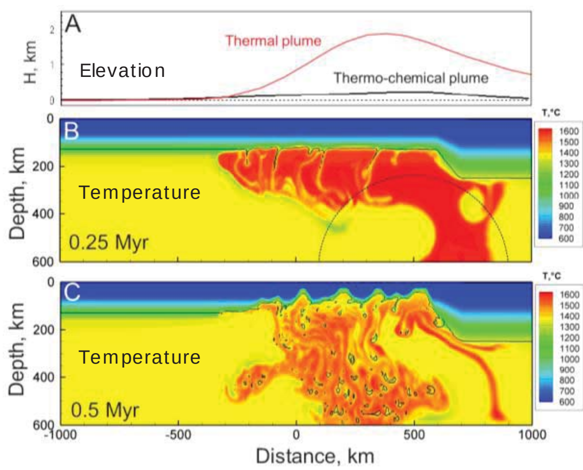

Figure 1: Model of rapid destruction of thick cratonic lithosphere by thermochemical plume without pre-magmatic surface uplift [1].

Recently, a numeric model of LIPs formation focused at Siberian LIP [1] explained rapid destruction of the cratonic lithosphere by the thermo-chemical mantle plume having potential temperature of 1600°C and containing large amount (15 Wt%) of recycled oceanic crust. The huge amount of melt generated from this plume intruded into the lithosphere and caused its delamination/foundering in less than 1 mln years (Figure 1).

In this study we explore limitations of this process. We demonstrate that realistic mantle plume with potential temperature up to 1650 °C, carrying as much recycled oceanic crust as it can remaining positively buoyant in the mantle, can significantly damage lithospheric root up to 200km thick.

[1] S.V. Sobolev et al. (2011) *Nature* **477**, 312-316.

Integrated geochemical and mineralogical investigation of lake deposits at Da Langtan (China) - implications for surface processes on Mars.

SOBRON, P.[1*], WANG, A.[2], MAYER, D.P.[3], SOBRON, F.[4], KONG, F.J.[5], ZHENG, M.P.[5]

[1]Canadian Space Agency, St. Hubert, Canada, pablo.sobron@asc-csa.gc.ca (* presenting author)
[2]Dept. of Earth and Planetary Sciences and the McDonnell Center for the Space Sciences, Washington University in St. Louis, St. Louis, USA, alianw@levee.wustl.edu
[3]Clark University, Worcester, USA, dmayer@clarku.edu
[4]Unidad Asociada UVa-CSIC, Centro de Astrobiologia (CAB-INTA), Valladolid, Spain, sobron@iq.uva.es
[5]R&D Center of Saline Lakes and Epithermal Deposits, Chinese Academy of Geological Sciences, Beijing, China, kongjie69@hotmail.com, zmp@public.bta.net.cn

The Qaidam Basin (QB)(32°-35°N/90°-100°E), located in the northern edge of the Qinghai-Tibet Plateau (China), is a high-altitude desert (aridity index ~0.04). Located at ~3000 m above sea-level, the basin features numerous dissicated evaporative lakes. Fig. 1 displays a partially eroded anticlinal structure (Xiao Liangshan (XL)) within the remains of a former lake in the Da Langtan (DL) playa region of the QB. The evaporation of the lake occourred in parallel with the rise of the anticline, thus producing the spectacular sequence of light and dark-toned rings shown in Fig. 1. This sequence depicts the multiple stages in the evolution of the lake. In-situ IR reflectance spectra were recorded along a traverse across XL, and samples were collected for subsequent laboratory analysis using Vis-NIR reflectance spectroscopy, Raman spectroscopy, and laser-induced breakdown spectroscopy (LIBS). XL was also imaged by Hyperion onboard NASA's EO-1 satellite to extract spectral endmembers from the scene and generate a mineral facies classification map. The surface mineralogy includes carbonates, gypsum, halides, hydrated Mg- and Na-sulfates, and chlorites. This mineral sequence resembles that observed at various locations on Mars, particularly at Gale crater. We have built a lake evaporation model that constrains the physico-chemistry of the DL lake's water (T, pH ...), and can help understand the occurrence of water-related mineral deposits and elucidate the geochemistry of putative former aqueous systems on Mars that resemble those we are investigating at Da Langtan.

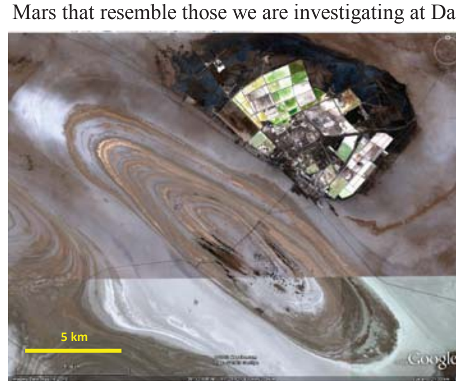

Figure 1: Xiao Liangshan image. Note the ring structure of the deposits across the anticline. Older deposits are on top.