



GM2013

**Critical Metals: Geochemistry
Mineralogy and Ore Deposits**

July 3-5, 2013



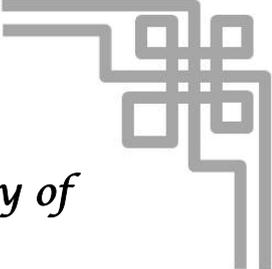
**2nd International Workshop
Ulaanbaatar, Mongolia**

Workshop sponsors:



UNIVERSITY
OF MANITOBA

Clayton H. Riddell Faculty of
Environment, Earth, and Resources



International Workshop on the Geology and Metallogeny of Critical Metals (CM2013)

Venue and location

This Workshop will be held on July 3-5 2013, in Ulaanbaatar, Mongolia. It will provide a unique forum for discussion of the origin and evolution of rare-earth, Nb, Ta, Li, Mo and In deposits, and related processes in igneous, hydrothermal, metamorphic and supergene environments. Keynote talks by Mongolian and international experts will address key current issues facing critical-metals research, exploration, mining, remediation and global supply market. Geologists, petrologists, mineralogists, geochemists, technologists and market experts are all welcome to attend, contribute to the Workshop and explore gorgeous Mongolia!

The Technical Sessions will take place on the campus of the Mongolian University of Science and Technology (MUST), located at 34 Baga Toiruu, just a short walk away from most downtown hotels, the Sukhbaatar Square and other city attractions (see map on page 6). The workshop will be accompanied by a rich cultural program and followed by a fieldtrip (July 6-10) to the most geologically interesting sites and deposits of critical metals in the heart of the Gobi Desert in southern Mongolia.

Ulaanbaatar, or UB City as it is colloquially known, is situated in the north-central Mongolia. The city is connected to both the Trans-Siberian Railway and China Railways. The city lies at an elevation of 1300 m (4300 ft) above sea level and, despite its reputation as the world's coldest capital, has comfortable +11-23°C (52-73 °F) weather in July. It is also one of the sunniest capitals, with an average of less than 70 mm of precipitation and mostly clear skies throughout mid-summer.

Please bookmark our website, <http://www.criticalmetalsmeeting.com/>, and visit us regularly for updates on the registration, abstract submission, fieldtrip and other information. Any urgent queries regarding the Workshop can be sent to Dr. Jindrich Kynicky (kynicky@mendelu.cz). Any visa-related requests should be addressed to Prof. Ochir Gerel (gerel@must.edu.mn). Abstracts should be e-mailed to Prof. Anton Chakhmouradian (chakhmou@cc.umanitoba.ca) by May 24, 2013 (see page 2 for details).

Organizing Committee

Prof. Ochir Gerel, MUST, Ulaanbaatar, Mongolia (Chair, Local Organizing Committee)

Prof. Munkhtsengel Baatar, MUST, Ulaanbaatar, Mongolia (Program and Guidebook)

Dr. Uondon Majigsuren, MUST, Ulaanbaatar, Mongolia (Fieldtrip Coordinator)

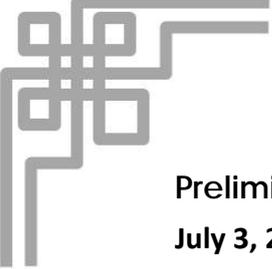
Dr. Jindrich Kynicky, Mendel University, Czech Republic (Chair, CM Workshop series)

Prof. Anton Chakhmouradian, University of Manitoba, Canada (Co-chair, Publicity)

Prof. Xu Cheng, Peking University, Beijing, China

Dr. Martin Smith, University of Brighton, United Kingdom

Dr. Ekaterina Reguir, University of Manitoba, Canada



Preliminary Workshop Program

July 3, 2013 (Wednesday)

Arrival and registration. On-site registration will take place in Building 2 of the MUST (34 Baga Toiruu), starting at 4:00 pm

6:00 pm *Icebreaker at Chingis* (Jamyran Street, one block south of the Sukhbaatar Square), Ulaanbaatar

July 4, 2013 (Thursday)

Conference Hall, MUST

9:30-10:00 am *Welcome and announcements*

10:00-12:00 **Session 1. Critical and Strategic Metals: the Global Picture (keynote talks)**

12:00-2:00 pm *Lunch break and photo*

2:00-4:00 **Session 2. Deposits of Critical Metals: Key Examples Worldwide**

4:00-4:20 *Coffee break*

4:20-6:00 **Session 2. Deposits of Critical Metals: Key Examples Worldwide**

7:00 *Conference banquet at Blue Moon*

July 5, 2013 (Friday)

Conference Hall, MUST

9:45-10:00 am *Announcements*

10:00-12:00 **Session 3. "Critical metallogeny": the Roles of Magma Evolution, Magma-wallrock Interaction and Hydrothermal Overprint**

12:00-2:00 pm *Lunch break*

2:00-4:00 pm **Session 3. "Critical metallogeny": the Roles of Magma Evolution, Magma-wallrock Interaction and Hydrothermal Overprint**

4:00-4:20 pm *Coffee break*

4:20-6:00 pm **Session 4. Recent Progress in Analytical Techniques and Exploration Methods**

Abstract submission

You are invited to submit a one-page abstract of your presentation (formatted to a 8.5 × 11" letter page), typed in Times New Roman 12 pts, single-spaced. Please give the title of your abstract in bold font (but NOT capitalized throughout), centered. The title should be followed by authors' names (given name – initials – family name, TNR, 12 pts) and their affiliations (TNR, 9 pts). The main body of the abstract should be followed by a list of References (TNR, 9 pts). An example of a properly formatted abstract is given on page 7. Please e-mail your abstract to Anton Chakhmouradian (chakhmou@cc.umanitoba.ca) **by May 24, 2013.**

Workshop Registration Fees*

Regular	Registration	380	USD
Student	Registration	250	USD
Accompanying	guest	250	USD

* The fees include access to the Technical Sessions, conference materials (including an abstract volume), tickets to the Icebreaker on July 3 and Conference Banquet on July 4, and lunch on July 4 and 5.

The payment of the registration Fee (and Fieldtrip Fee, if applicable; see below) should be done by bank transfer (at no charges to the beneficiary) to:

Beneficiary: Petr Maděra (Nadační fond prof. Aug. Bayera)

Account no.: 102620200/0300; **bank name:** Ceskoslovenska obchodni banka, a. s. (CSOB); Radlicka 333/150, Praha 5, Czech Republic, 15057; **bank code:** 0300

IBAN: CZ90 0300 0000 0001 0262 0200; **SWIFT:** CEKOCZPP

Do not forget to indicate your name in the bank transfer. Participation in the Workshop or fieldtrip is not guaranteed until the full payment of the registration fee has been received.

Pre- and post-meeting excursions

Depending on the level of interest, trips to the following facilities and cultural attractions in, or in the vicinity of, Ulaanbaatar can be organized. If you are interested in any of these activities, please contact us ASAP and indicate whether you would prefer to have them organized prior to, or following the Workshop:

- (1) Excursion to the Natural History Museum and Central Geological Laboratory
- (2) Geological and sightseeing excursion to Gorkhi Terelj National Park
- (3) Excursion to the Gandantegchinlen Khiid (Buddhist monastery)

Fieldtrip

Rare Metals, Porphyries and Peralkaline Granites: A Fieldtrip into the Heart of the Gobi Desert

This fieldtrip will take you to some of the most geologically interesting sites in the heart of the Gobi Desert, southern Mongolia. We will see carbonatites and associated REE deposits at Lugiin Gol, the world's largest pluton of peralkaline granites at Khan Bogd, one of the Asia's richest Mo-Cu-Au porphyry deposits at Oyu Tolgoi and various cultural and historic sites along the way. We will depart to the Oyu Tolgoi mine camp in the evening of July 6 from Ulaanbaatar airport, and return to Ulaanbaatar in the afternoon of July 9. The fieldtrip route is shown on the map on page 6.

The fieldtrip fee of 590.00 USD (480 USD for students) will include: return airfare from Ulaanbaatar to Oyu Tolgoi, vehicle rental, meals and accommodation in the Oyu Tolgoi camp, and a fieldtrip guidebook. For logistical reasons, the number of participants is limited to 20 people. Unfortunately, cancellations and refunds will not be possible once the fieldtrip fee has been deposited and processed.



Finalized Fieldtrip Program

July 6, 2013 (Saturday)

Departure for Oyu Tolgoi (by plane, 550 km)
Tour of the Oyu Tolgoi Mo-Cu-Au mine (South Gobi)
Trip to the Khanbogd alkali-granite pluton (South Gobi)
Overnight accommodation in the Oyu Tolgoi camp

July 7, 2013 (Sunday)

Departure for Lugiin Gol (by car, 180 km)
Lugiin Gol REE deposit (East Gobi)
Overnight accommodation in the Lugiin Gol camp

July 8, 2013 (Monday)

Departure for Ulgii Khiid (by car, 100 km)
Ulgii Khiid syenites and carbonatites (East Gobi)
Departure for Oyu Tolgoi (by car, 180 km)
Overnight accommodation in the Oyu Tolgoi camp

July 9, 2013 (Tuesday)

Departure for Ulaanbaatar (by plane, 550 km)

For further information or clarification, please contact one of the fieldtrip leaders:

Jindrich Kynicky (kynicky@mendelu.cz),

Anton Chakhmouradian (anton.chakhmouradian@ad.umanitoba.ca), or

Uondon Majigsuren (majigsuren@yahoo.com)

Logistics

Visa

Citizens of the following countries do not require a visa to visit Mongolia for a period of less than 90 days: Belarus, Kazakhstan, Kyrgyzstan, Ukraine, and the United States. Citizens of the following countries do not require a visa to visit Mongolia for a period of less than 14 days: Cuba, Georgia, Hong Kong, Israel, Japan, Laos, Malaysia, Singapore, Thailand and Philippines. The issuance of visas outside Mongolia is managed by the Ministry of Foreign Affairs through its Embassies, Consulates and Honorary Consulates worldwide. These authorities are authorized to issue single-entry 30-day visas for tourists (J) and business travelers (B). Please make sure you familiarize yourself with the Mongolian visa requirements in your country and allow adequate time for visa processing. The Organizing Committee will be happy to assist you in these matters. Any visa-related requests should be addressed to Prof. Ochir Gerel, Chair of the Local Organizing Committee (gerel@must.edu.mn).

Getting there

Ulaanbaatar is serviced by direct flights from Tokyo, Osaka, Beijing, Hong Kong, Shanghai, Seoul, Singapore, Berlin, Moscow, Irkutsk and Ulan Ude (<http://www.discovermongolia.mn/flights.php>). You will arrive at the Chinggis Khan International Airport ~15 km SW of downtown Ulaanbaatar. Normally, there is a plenty of taxis waiting outside the arrival area, and a normal one-way fare to downtown Ulaanbaatar should not exceed \$15 (i.e. 21,000 Mongolian Tugriks, MNT). Take a designated taxi rather than hitching a ride from hustlers crowding the airport lobby. In UB City, hotel staff typically speaks fluent English. If you are not comfortable cabbing to your hotel, please let us know and a Workshop representative will pick you up.

Accommodation

In the downtown area, there are plenty of hotels for every taste and budget; the ones nearest the MUST campus are marked on the map on page 6. We recommend Hotel Puma Imperial (www.pumaimperialhotel.mn), located between the MUST and Sukhbaatar Square (a great place for an early-morning walk and a spectacular sight any time of the day). The current room rates are listed in the table below (conversion rate: \$1 = 1,380 MNT; €1 = 1,800 MNT; 1RUB = 44 MNT; 1RMB = 223 MNT). The Hotel can be reached at: puma_imperial@mbox.mn

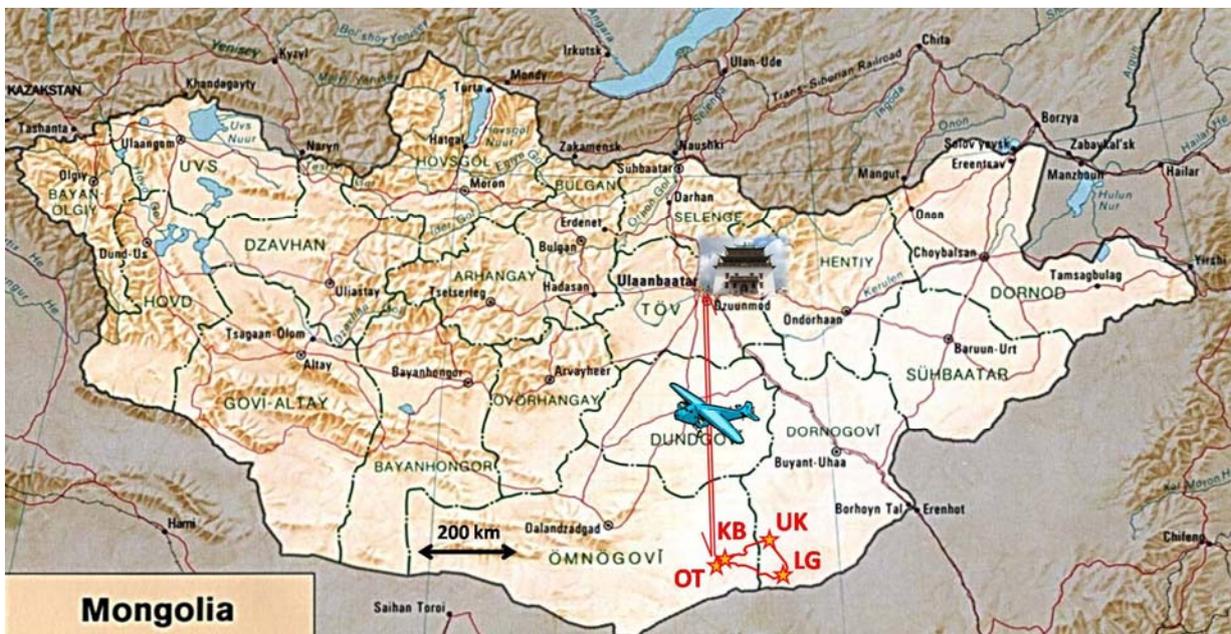
Room rates	Single	Double
Semi Deluxe	240,000 MNT	280,000 MNT
Standard Double-A	220,000	260,000
Standard Twin	200,000	250,000
Standard Double-B	170,000	210,000
Extra bed	65,000	65,000

Important dates and deadlines

- May 24, 2013** Abstract submitted (see pages 2 and 7)
- June 7, 2013** Workshop registration fee paid in full (see page 3)
- June 7, 2013** Fieldtrip fee paid in full (see page 3)
- June 14, 2013** Presentations scheduled, presentation times announced
- July 3-5, 2013** Workshop
- July 6-9, 2013** Fieldtrip



Downtown Ulaanbaatar map (from <http://maps.google.com/>), showing the location of the Mongolian University of Science and Technology (1), nearby hotels (2 Puma Imperial; 3 Zaluuchuid; 4 Ulaanbaatar) and selected attractions (5 Sukhbaatar Square; 6 Museum of Natural History; 7 Zanabazar Museum of Fine Arts).



Map of Mongolia (from www.e-mongol.com) showing the fieldtrip route (Ulaanbaatar – Oyu Tolgoi – Khan Bogd – Lugiin Gol – Ulugei Khiid – Oyu Tolgoi – Ulaanbaatar).

Monticellite: a neglected rare-earth host in mantle-derived undersaturated rocks and its significance for magma evolution

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Monticellite (ideally CaMgSiO_4) is a common groundmass phase in kimberlites, as well as some carbonatites and ultramafic lamprophyres as (micro)phenocrysts or in the groundmass. In lesser quantities, this mineral occurs in some ultramafic plutonic rocks associated with carbonatites [1-3]. Despite its obvious petrologic significance, virtually nothing is known about the trace-element chemistry of monticellite from any of these rocks, or on how it affects the evolution of mantle-derived Ca-rich ultrabasic magmas (~20-25 wt.% SiO_2 , 12-15 wt.% MgO and 22-28 wt.% CaO). Assessment of the petrochemical role of monticellite has so far been hindered by the common occurrence of earlier-crystallized olivine (+/- other minerals) in the same rock.

Our data demonstrate that monticellite is an important host for rare-earth elements in some mantle-derived rocks, containing up to several hundred ppm REE and showing a strong preference for heavy lanthanides (chondrite-normalized $\text{La/Yb} = 0.02-0.5$). Monticellite-groundmass partition coefficients, calculated for unserpentinized subvolcanic ultramafic lamprophyre from Kontozero (Kola Peninsula, northwestern Russia), range from 0.01 (La) to ~20 (Lu), suggesting that this mineral serves as the principal repository for heavy REE. The Y/Ho ratio in this mineral is consistently superchondritic (28-50), and the calculated Y partition coefficient is about 1.5 times higher than the Ho value. The preferential uptake of heavy REE and Y by this mineral contrasts with the partitioning behavior of perovskite in the same magma types [4]. Our calculations also indicate a much greater compatibility of Co in monticellite relative to Ni ($D = 0.9$ and 0.05 , respectively). To summarize, fractionation of monticellite from Ca-rich ultrabasic magmas will lead to derivative melts enriched in light REE, but showing anomalously low Y/Ho and Co/Ni ratios ($\ll 28$ and 0.05 , respectively), and to monticellite-rich cumulate rocks showing a complementary trace-element signature.

References cited:

- [1] Mitchell, R.H. (1986) Kimberlites: Mineralogy, Geochemistry, and Petrology. Plenum Press, New York, 464 pp.
- [2] Mitchell, R.H. and Belton, F. (2004) Niocalite-cuspidine solid solution and manganese monticellite from natrocarbonatite, Oldoinyo Lengai, Tanzania. *Mineralogical Magazine*, 68, 787-799.
- [3] Tappe, S., Steinfelt, A., Heaman, L.M. and Simonetti, A. (2009) The newly discovered Jurassic Tikusaaq carbonatite-aillikite occurrence, West Greenland, and some remarks on carbonatite-kimberlite relationships. *Lithos*, 112S, 385-399.
- [4] Chakhmouradian, A.R., Reguir, E.P., Kamenetsky, V.S., Sharygin, V.V. and Golovin, A.V. (2013) Trace-element partitioning in perovskite: Implications for the geochemistry of kimberlites and other mantle-derived undersaturated rocks. *Chemical Geology* (in press).