



Annual Report* of IGCP Project No. 592

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IGCP project short title: “Continental construction in Central Asia”

Duration: 2012-2015

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Date of submission of report: December 14, 2013

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Abbreviations used in the report: CAOB – Central Asian Orogenic Belt; IAGR – International Association for Gondwana Research; IAGOD - International Association on the Genesis of Ore Deposits; CERCAMS - Centre for Russian and Central Eurasian Mineral Studies; IGM – Institute of Geology and Mineralogy; KIGAM - Korea Institute of Geoscience and Mineral Resources; OPS – Ocean Plate Stratigraphy; WP – western Pacific.

1. Website address(es) related to the project

<https://sites.google.com/site/igcp592/home> or <http://igcp592.igm.nsc.ru> - official IGCP#592 site
<http://izk.irkmail.ru/ieng.html> - website of Meeting #1, Irkutsk, Russia
http://www.igg.cas.cn/heil/jldt/201310/t20131008_3944169.html, report of Meeting #2 at the IGG CAS site
<http://geo.stbur.ru/doc/circular-2013-08-2.pdf> - website of Meeting #3, Ulan-Ude, Russia
<http://iagr2013.kigam.re.kr> – website of Meeting #4, Daejeon, Republic of Korea
<http://www.cvent.com/events/geosciences-2013-conference/event-summary-5cb5c6cf843848df87f293052ac744e0.aspx> – website of Meeting #5, Christchurch, New Zealand
<http://www.nhm.ac.uk/cercams> - official website of CERCAMS led by co-leader Reimar Seltmann
<http://www.igm.nsc.ru/labs/lab212/~safonova/english/safonova-index-engl.htm> – website of Inna Safonova
<http://www.iagrhomepage.com/> - website of the International Association for Gondwana Research
<http://www.conferencenet.org/conference/iccd.htm> - website of 2014 meeting in Xi'an, China
<http://www.convergentmargins.com/> - website of 2014 meeting in Trabzon, Turkey
<http://www.gondwana15.org/> - website of the 2014 meeting in Madrid, Spain
<http://conf.uran.ru/default.aspx?cid=12ips> - website of 2014 meeting in Yekaterinburg, Russia
<http://www.14iagod.org/en/> - website of 2014 meeting in Kunming, China
http://www.iagrhomepage.com/zb_users/upload/2013/10/IAGR_2014_convention.pdf - 11th IAGR Meeting
<http://www.episodes.co.in/contents/2013/september/pp227-234.pdf> - paper on 2012 results in Episodes.

2. Summary of major past achievements of the project

During the previous year (2012), the IGCP-592 results addressed i) evaluation of juvenile to recycled crust in the CAOB; ii) assessment of accretion as part of continental construction; iii) formation of mineral deposits; iv) environmental impact. The 2012 general achievements were: a) lithostratigraphic comparison of CAOB and WP; b) combination of U-Pb zircon ages with Nd and Hf isotopes for elucidation of source characteristics; c) Early-Middle Paleozoic peak of subduction-accretion related crustal growth in the eastern CAOB; d) combination of geology and petrologic modelling in studying PGE-Ni mineral deposits; e) formation of porphyry deposits by a subduction-related input of juvenile material.

3. Achievements of the project

3.1. List of countries involved in the project (* - active this year):

Australia*, Austria*, Bangladesh*, Belgium*, China*, Czech Republic*, France*, Germany*, India*, Indonesia*, Iran, Israel*, Japan*, Kazakhstan*, Republic of Korea*, Kyrgyzstan*, Madagascar*, Malaysia, Mongolia*, Myanmar, Nepal*, Netherlands*, New Zealand*, Norway*, Poland*, Russia*, South Africa*, Switzerland*, Taiwan, Tajikistan, Thailand*, United Kingdom*, USA*, Uzbekistan*, Vietnam* (35 countries).

3.2. General scientific achievements and social benefits

In 2013, the research activities in the frame of IGCP#592 were performed in four **main fields/topics**.

a) *Tectonics and geodynamics of the CAOB* with special focuses to: i) geodynamic settings of magmatism (Biske et al., 2013; Guy et al., 2014; Kislov, 2013; Shen et al., 2013; Wan et al., 2013; Wang et al., 2013); ii) tectonic patterns formed after ocean closure and post-collisional processes (Gao et al., 2013; Guy et al., 2014; Tian et al., 2013); iii) kinematics of orogeny and accretionary tectonics (Song et al., 2013b; Xu et al., 2013; Zhang et al., 2013); iv) lithostratigraphy-based tectonic reconstructions (Gao et al., 2013; Novikov, 2013); v) intra-plate rifting (Rasskazov et al., 2013; Novikov et al., 2013).

b) *Geochronology of major magmatic and tectonic events of the CAOB* with special focuses to: i) dating of granitoids and shear zones (Guy et al., 2014; Konopelko et al., 2013; Zhang et al., 2013); ii) age and juvenile vs recycled character of CAOB basement terranes (Hara et al., 2013; Huang et al., 2013; Kim et al., 2013; Kröner et al., 2013; Wang et al., 2013; Zhang et al., 2013); iii) provenance analysis of metasediments (Song et al., 2013a;

Zhu *et al.*, 2014); iv) secular changes of crustal growth from the Archean to the Phanerozoic (Kim *et al.*, 2013; Kröner *et al.*, 2013; Kuski *et al.*, 2013; Zhang *et al.*, 2013).

c) *Multi-disciplinary correlations between the CAOB and WP* with special focuses to: i) accretionary orogeny in the Tasmanides of eastern Australia (Glen, 2013; Glen *et al.*, 2013; Zhang *et al.*, 2013; Mortimer, 2013); ii) OPS in Archean-Phanerozoic accretionary orogens (Kim *et al.*, 2013; Kuski *et al.*, 2013; Safonova and Maruyama, 2013; Safonova and Santosh, 2014); iii) Pacific-type and Collision-type orogens, tectonic erosion and arc subduction, and intra-plate magmatism of CAOB and WP (Hara *et al.*, 2013; Kim *et al.*, 2013; Mortimer, 2013; Shen *et al.*, 2013; Safonova and Maruyama, 2013; Wan *et al.*, 2013; Zhang *et al.*, 2013); iv) project activities and results (Safonova *et al.*, 2013).

d) Mineral Deposits of CAOB with special focuses to: i) formation of Mo–Cu deposits and magma mixing (Ma *et al.*, 2013); ii) age, parental magmas, geodynamics and metallogeny of porphyry Cu-Au/Mo deposits (Dolgoplova *et al.*, 2013a,b; Plotinskaya and Grabezhev, 2013; Seltmann *et al.*, 2013; Zhang *et al.*, 2013); iii) mineralization style and geochronology of gold deposits (Naumov *et al.*, 2013; Goldfarb *et al.*, 2014); iv) Cu-Ni sulfide deposits (Han *et al.*, 2013a, b).

Major results/conclusions of the 2013 research activities are:

1. Recognition of both P- and C-type orogenic belts in CAOB and correlation of the former with WP.
2. New isotope geochronological and geochemical data proved a mixed character of CAOB crust despite dominating P-type orogens as a result of tectonic erosion and subduction of intra-oceanic arcs.
3. Major epochs of metallogeny in CAOB are related to certain geodynamic settings, e.g., the 290 Ma peak of Ni-Co sulphide mineralization related to plume-related decompression melting, ascent of melts via translithospheric faults, melt-crust interaction and, finally Cu-Ni-Co-sulphide accumulation.
4. OPS units occur in both, Phanerozoic (CAOB, WP) and Archean-Proterozoic accretionary orogens.
5. The *social benefits* result from i) focused resource studies to obtain a better understanding of mineral deposits' formation and societal needs; ii) environmental impact, and iii) training of young scientists.

3.3. List of meetings with approximate attendance and number of countries

1. 2nd symposium and training school for young scientists “Continental rifting and accompanying processes”, Irkutsk, Russia, August 20-23, 2013; about 80 participants from 6 countries.
2. International Field Trip and Workshop “Beishan Orogen in NW China: accretionary tectonics, magmatism, eclogite and granulite complexes”, Urumqi-Hami-Dunhuang, China, August 22-27, 2013; about 60 participants from 16 countries.
3. IV conference «Geodynamics and metallogeny of NE Asia”, Ulan-Ude, Russia, August 26-31, 2013; about 70 participants from 3 countries.
4. The 2013 IAGR Annual Convention and 10th International Symposium on “Gondwana to Asia”, Daejeon, Republic of Korea, about 80 participants from 14 countries.
5. Session “IGCP 592: Accretionary Belts of the SW Pacific Central Asia” at the GSNZ 2013 Annual Conference, Christchurch, New Zealand, November 24-27, 2013; 30 participants from 4 countries.

3.4. Educational, training or capacity building activities

1. Field training on mineral deposits; Khivy-Sultan-Uvais, Uzbekistan; 9 participants from Uzbekistan, Norway and UK; supervisor: Prof. Reimar Seltmann; April 26 – May 3, 2013;
2. Field training on OPS; Mino accretionary complex, Inuyama area, Japan; 5 participants from Japan, Russia and USA; supervisor: Prof. Shigenori Maruyama; May 12-13, 2013;
3. Seminar on the CAOB and WP; University of Tokyo, Tokyo, Japan; 12 participants from Japan and Russia; supervisors: Prof. Tsuyoshi Komiya, Dr. Inna Safonova; May 29, 2013;
4. Field training on mineral deposits; Irtysh shear zone, Oskemen, Kazakhstan; 9 participants from Kazakhstan and UK; supervisor: Prof. Reimar Seltmann; June 15-30, 2013;
5. Best poster challenge at the 10th IAGR Symposium; KIGAM, Daejeon, Korea; 34 PG and PhD students from China, Japan and Republic of Korea; supervisor: Prof. Wilfred Winkler; October 2, 2013;
6. Field training for young scientists; Lake Baikal, Russia; supervisor: Prof. S. Rasskazov; August 20-23.
7. Short course “Geodynamics & Metallogeny of central Asia”; EKSTU, Oskemen, Kazakhstan; 8 PhD students; supervisor: Reimar Seltmann; October 6-19, 2013.

8. Short lecture course on environmental problems connected with geological processes in Central Asia; Kyzyl-Orda University, Kazakhstan; supervisor: Prof. S. Krivonogov, December 2-16, 2013.

3.5. Participation of scientists from developing countries, young and women scientists

The geographic position of the major areas of interest (Central and East Asia) determines the high portion of project participants from developing countries, namely, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Uzbekistan, plus participants from developing countries outside the CAOB but involved into its study: Bangladesh, India, Indonesia, Nepal, Thailand, Vietnam; in average 85% of totally about 400 participants of the 2013 IGCP#592-related meetings. Among those supported by IGCP#592 are about 30% female scientists and 40% young scientists. 90% of participants supported by IGCP#592 are of these 3 categories, i.e. female / young scientists and from developing countries (see below Paragraph 7 and Form III).

3.6. List of most important publications

Conference proceedings of the meetings sponsored or co-sponsored by IGCP#592

1. Kim, S.W., Park, S.I. (Eds.), 2013. The 2013 IAGR Annual Convention and 10th Int'l Symposium on Gondwana to Asia, KIGAM, Daejeon, S. Korea, 1-4 Oct., 2013, IAGR Conf. Series No. 14, Abstr. vol.
2. Mortimer, N., H. Campbell, 2013. The Mesozoic Accretionary Orogen of Zealandia. GSNZ 2013 Field Trip 8, Univ. Canterbury, Christchurch, New Zealand, November 24 – December 3, 2013.
3. Rasskazov, S.V., Nikishin, A.M., Primina, S.P. (Eds.), 2013. Continental rifting, accompanying processes. Proc. 2nd Symp. Inst. Earth's Crust SB RAS, Irkutsk, Russia, Aug. 20-23, 2013.
4. Tsygankov, A.A., Kislov, E.V. (Eds.), 2013. Geodynamics and Formation of Mineral Deposits in North-East Asia. Proc. of the 4th conference, Geological Institute SB RAS, EKOS, Ulan-Ude.
5. Zhang, Z., Xiao W., Safonova I. (Eds.), 2013. Beishan Orogen in NW China: accretionary tectonics, magmatism, eclogite and granulite complexes. Int'l Field Trip and Workshop under IGCP Project #592 "Continental construction in Central Asia", August 22-28, 2013, Hami, Xinjiang, China.

Peer-reviewed papers and extended abstracts (pr – peer-reviewed)

1. [pr](#) Biske Yu.S., Konopelko D.L., Seltmann R., 2013. Geodynamics of Late Paleozoic Magmatism in the Tien Shan and Its Framework. *Geotectonics* 47, 291–309.
2. [pr](#) Dolgoplova A., Seltmann R., Armstrong R. et al., 2013a. Sr–Nd–Pb–Hf isotope systematics of the Hugo Dummett Cu–Au porphyry deposit (Oyu Tolgoi, Mongolia). *Lithos* 164–167, 47–64.
3. Dolgoplova A., Seltmann R., Armstrong R., Belousova E., Pankhurst R.J., Konopelko D., Koneev, R., 2013b. Sr–Nd–Hf–Pb isotope mapping of Tien Shan in Uzbekistan. *Goldschmidt 2013 Conf. Abstracts*.
4. [pr](#) Gao X., Liu L., Jiang L., Shang X., Liu G., 2013. A pre-Paleogene unconformity surface of the Sikeshe Sag, Junggar Basin: implications for transportation of hydrocarbons. *Geoscience Frontiers* 4, 779–786.
5. [pr](#) Glen R.A., 2013. Refining accretionary orogen models for the Tasmanides of eastern Australia, *Australian J. Earth Sci.* 60:3, 315–370.
6. [pr](#) Glen R.A., Korsch R.J., Hegarty R., Saeed A., Poudjom Djomani Y., Costelloe R.D., Belousova E., 2013. Geodynamic significance of the boundary between the Thomson Orogen and the Lachlan Orogen, NW New South Wales and implications for Tasmanide tectonics. *Aust. J. Earth Sci.* 60, 371–412.
7. [pr](#) Goldfarb, R.J., Taylor R. D., Collins G.S., Goryachev N.A., Orlandini O.F., 2014. Phanerozoic continental growth and gold metallogeny of Asia. *Gondwana Research* 25, 48–102.
8. [pr](#) Guy A., Schulmann K., Clauer N., Hasalová P., Seltmann R., Armstrong R., Lexa O., Benedicto A., 2014. Late Paleozoic–Mesozoic tectonic evolution of the Trans-Altai and South Gobi Zones in southern Mongolia based on structural and geochronological data. *Gondwana Research* 25, 309–337.
9. [pr](#) Han, C., Xiao, W., Zhao, G., Su, B.-X., Sakyi, P.A., Ao, S., Wan, B., Zhang, J., Zhang, Z., 2013a. SIMS U–Pb zircon dating and Re–Os isotopic analysis of the Hulu Cu–Ni deposit, eastern Tianshan, CAOB, and its geological significance. *Journal of Geosciences* 58, 255–274.
10. [pr](#) Han, C., Xiao, W., Zhao, G., et al., 2013b. Age and tectonic setting of magmatic sulfide Cu–Ni mineralization in the Eastern Tianshan Orogenic Belt, Xinjiang, Central Asia. *J. Geosci.* 58, 237–254.
11. [pr](#) Hara, H., Kurihara, T., Tsukada, K., Kon, Y., Uchino, T., Suzuki, T., Takeuchi, M., Nakane, Y., Nuramkhaan, M., Chuluun, M. et al., 2013. Provenance and origins of a Late Paleozoic accretionary complex within the

- Khangai–Khentei belt in the CAO, central Mongolia. *J. Asian Earth Sci.* 75, 141-157.
12. [Huang, Z., Xiaoping, L., Kröner, A., Yuan, C., Wang, Q., Sun, M., Zhao, G., Wang, Y., 2013.](#) Geochemistry, zircon U–Pb ages and Lu–Hf isotopes of early Paleozoic plutons in the northwestern Chinese Tianshan: Petrogenesis and geological implications. *Lithos* 182-183, 48-66.
 13. [Kim, J.Y., Krivonogov, S.K., Lee, Y.J. et al., 2013.](#) Climatic stages recorded in sediments of the Gunang Cave, South Korea. *Quaternary International* 313-314, 194-209.
 14. [Konopelko D., Seltmann R., Apayarov F., Belousova E., Izokh A., Lepekhina E., 2013.](#) U–Pb–Hf zircon study of two mylonitic granite complexes in the Talas-Fergana fault zone, Kyrgyzstan, and Ar–Ar age of deformations along the fault. *Journal of Asian Earth Sciences* 73, 334–346.
 15. [Kusky, T., Windley, B., Safonova, I., Wakita, K., Wakabayashi, J., Polat, A., Santosh, M., 2013.](#) Recognition of Ocean Plate Stratigraphy in accretionary orogens through Earth history: A record of 3.8 billion years of sea floor spreading, subduction & accretion. *Gondwana Research* 24, 501-547.
 16. [Kröner, A., Alexeiev D.V., Rojas-Agramonte Y., Hegner E., Wong J., Xia X., Belousova E., Mikolaichuk A.V., Seltmann R., Liu D., Kiselev, V.V., 2013a.](#) Mesoproterozoic (Grenville-age) terranes in the Kyrgyz North Tianshan: Zircon ages and Nd–Hf isotopic constraints on the origin and evolution of basement blocks in the southern Central Asian Orogen. *Gondwana Research* 23, 272-295.
 17. [Ma X., Chen B., Yang M., 2013.](#) Magma mixing origin for the Aolunhua porphyry related to Mo–Cu mineralization, eastern Central Asian Orogenic Belt. *Gondwana Research* 24, 1152–1171.
 18. [Naumov E., Mizerny A., Seltmann R., et al., 2013.](#) Mineralization style and geochronology of the Sekisovka gold deposit, eastern Kazakhstan. SGA Biennial Meeting Uppsala, Sweden, pp. 1164-1167.
 19. [Novikov I.S., 2013.](#) Reconstructing the stages of orogeny around the Junggar basin from the lithostratigraphy of Late Paleoz., Mesozoic, and Cenozoic sediments. *Rus. Geol. & Geoph.* 54, 138–152.
 20. [Novikov I.V. et al., 2013.](#) Mud volcano origin of the Mottled Zone, South Levant. *Geoscience Frontiers* 4, 597-619.
 21. [Plotinskaya O. Yu., Grabezhev A.I., 2013.](#) Porphyry deposits of the Urals. SGA Biennial Meeting Uppsala, Sweden 12–15 August 2013, pp. 1516-1518.
 22. [Safonova I., Seltmann R., Sun M., Kröner A., Kovach V., Collins V., 2013.](#) Continental construction in Central Asia (IGCP592): scientific results and meetings in 2012. *Episodes* 36, 227-234.
 23. [Safonova, I.Y., Santosh, M., 2014.](#) Accretionary complexes in the Asia-Pacific region: Tracing archives of ocean plate stratigraphy and tracking mantle plumes. *Gondwana Research* 25, 126-158.
 24. [Safonova, I., Maruyama, S., 2013.](#) Asia: a frontier of a future supercontinent. In: Kim, S.W., Park, S. (Eds.) IAGR Conference Series No. 4, 2013 IAGR Annual Convention, Daejeon, pp. 20-22.
 25. [Seltmann R., Dolgoplova A., Porter T.M., Pirajno F., 2013.](#) Porphyry Cu-Au/Mo Deposits of Central Eurasia: Geodynamics and Metallogeny. SGA Biennial Meeting Uppsala, Sweden, pp. 872-875.
 26. [Shen, P., Pan, H., Xiao, W., Li, X.-h., Zhu, H., 2013.](#) Early Carboniferous intra-oceanic arc and back-arc basin system in the West Junggar, NW China. *International Geology Review* 55, 1991-2007.
 27. [Song D., Xiao W., Han C., et al., 2013a.](#) Provenance of metasedimentary rocks from the Beishan orogenic collage, southern Altai. *Gondwana Research* 24, 1127–1151.
 28. [Song, D., Xiao, W., Han C., et al., 2013b.](#) Progressive accretionary tectonics of the Beishan orogenic collage, southern Altai. *Precambrian Research*, 227, 368-388.
 29. [Tian Z., Xiao W., Shan Y., Windley B.F., Han C., Zhang J., Song D., 2013.](#) Mega-fold interference patterns in the Beishan orogen (NW China) created by change in plate configuration during Permo-Triassic termination of the Altai. *Journal of Structural Geology* 52, 119-135.
 30. [Wan, B., Xiao, W., Windley, B., Chao, Y., 2013.](#) Permian gabbros in the Chinese Altai from a subduction-related hydrous parent magma, not from the Tarim mantle plume. *Lithosphere* 5, 290-299.
 31. [Wang, H., Wu, Y.-B., Qin, Z.-W., et al., 2013.](#) Age and geochemistry of Silurian gabbroic rocks in the Tongbai orogen, central China: Implications for the geodynamic evolution of the North Qinling arc–back-arc system. *Lithos* 179, 1-15.
 32. [Xu, B., Charvet J., Chen, Y., Zhao, P., Shi, G., 2013.](#) Middle Paleozoic convergent orogenic belts in western Inner Mongolia (China): framework, kinematics, geochronology and implications for tectonic evolution of the Central Asian Orogenic Belt. *Gondwana Research* 23, 1342-1364.
 33. [Zhang, H.-F., Li, S.-R., Santosh, M., Liu, J.-J., Wu, C.R., Zhang, H., 2013.](#) Magmatism and metallogeny associated with mantle upwelling: Zircon U–Pb and Lu–Hf constraints from the gold-mineralized Jinchang granite, NE China. *Ore Geology Reviews* 54, 138-156.

34. [Zhu, X.-Q., Zhu W.-B., Ge, R.-F., Wang X., 2014.](#) Late Paleozoic provenance shift in the south-central North China Craton: Implications for tectonic evolution and crustal growth. *Gondwana Res.* 25, 383-400.

3.7. Activities involving other IGCP projects, UNESCO, IUGS or others

1. The IGCP#592 activities involved the programs of IAGR (Meeting #4 in Daejeon), CERCAMS (Meeting #2 in NW China), and Russian Mineralogical Society (Meeting #3 in Ulan-Ude - Baikal).
2. IGCP #592 and IGCP #628 (The Gondwana Map) co-chaired sessions at 10th Int'l Symp. "Gondwana to Asia" (October 2013, Korea). Two joint meetings in Madrid and Beijing are planned for 2014.
3. Several IGCP-592 project members participate also in activities of IGCP-599 "The Early Earth".
4. IGCP#592 co-operated with IUGS for advertising meetings (<http://iugs.org/index.php?page=2014-april>).

4. Activities planned

4.1. General goals

1. The increase the number of meetings (seven planned for 2014)
2. Expanding contacts in the Australasian region to ensure comparison of CAOB with WP.
3. To ensure if accretionary processes operated as early as in the Archean;
4. To determine whether crustal growth has changed since the Archean by evaluating the portion of juvenile crust by Hf isotopes of zircons and the portion of tectonically eroded TTG-type crust.

4.2. Tentative list of specific meetings and field trips (please list the participating countries)

1. Int'l Conf. "Continental Dynamics" and Field Trip to the Qinling Orogen, NW Univ. Xi'an, China, April 26-28, 2014; Australia, China, Japan, India, Russia; <http://www.conferencenet.org/conference/iccd.htm>
2. Int. Workshop "Convergent Margins" (with a short course for students) and Field Trip to the eastern Pontides, Karadeniz Technical University, Trabzon, Turkey, May 21-23, 2014; Australia, Canada, China, Germany, Russia, Turkey, USA; <http://www.convergentmargins.com/>
3. XII International Platinum Symposium, Yekaterinburg, Russia, Ural Federal University, August 11-14, 2014; <http://conf.uran.ru/default.aspx?cid=12ips> (Canada, China, Russia, UK, USA)
4. II Int'l Conf. "Granites and Earth's Evolution" and Altai Field Trip, IGM SB RAS, Novosibirsk, Russia, August 17-20; China, Japan, Russia; <https://sites.googlegroups.com/site/igcp592/milestone-meetings/>
5. IAGOD - 14th Quadrennial Int'l Association on the Genesis of Ore Deposits Symposium "Mineral Resources: Discovery and Utilization", Kunming, China, August 19-22; Australia, Canada, China, Czech, Germany, Japan, India, Iran, Russia, UK, USA; <http://www.14iagod.org/en/>
6. The 2014 IAGR Ann. Conv. and 11th "Gondwana to Asia" Int'l Conf., CUGS, Beijing; September 19-21, 2014; Australia, China, Japan, India, Korea, Kyrgyzstan, Russia; together with IGCP #628. http://www.iagrhomepage.com/zb_users/upload/2013/10/IAGR_2014_convention.pdf.