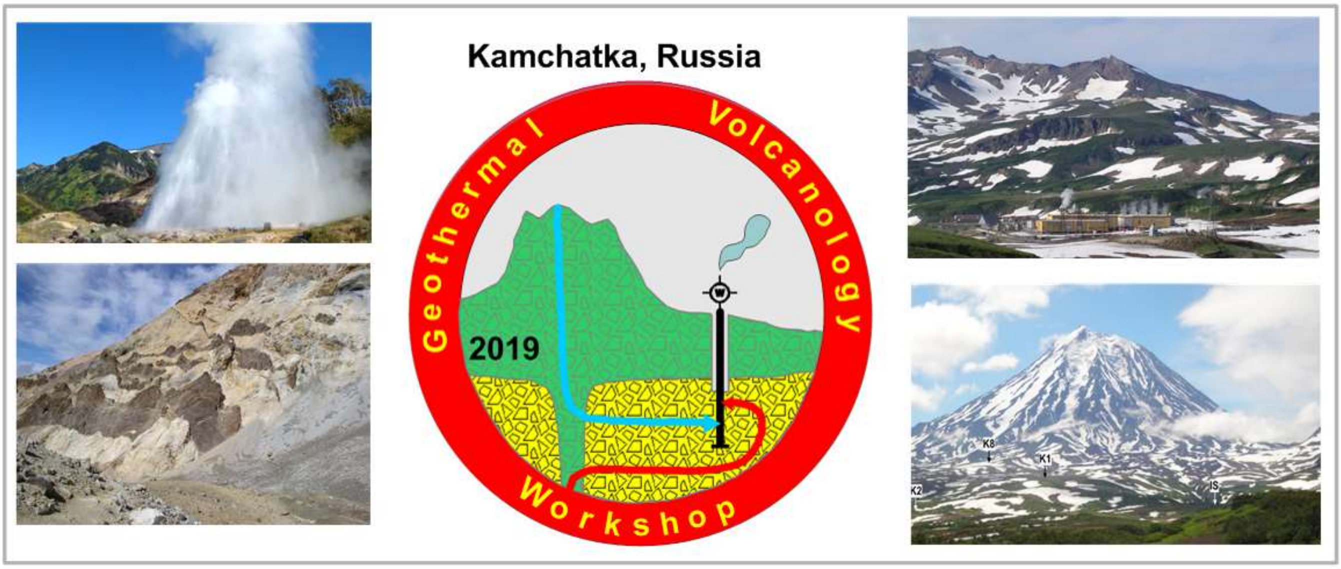
Geothermal Volcanology Workshop 2019

1st CIRCULAR (updated 28 May 2019)

Institute of Volcanology and Seismology, Far Eastern Branch, Russian Academy of Sciences, Petropavlovsk-Kamchatsky, September 05-09, 2019



Geothermal Volcanology Workshop 2019 will be held from **05 to 09 September 2019** in Petropavlovsk-Kamchatsky, Russia. Kamchatka is an active volcanic, seismic and hydrothermal region. Active volcanism is accompanied by magma injections into host structures, magmatic fracturing and the formation of hydrothermal systems adjacent to volcanoes. Engineering study of productive geothermal reservoirs is a necessary condition for their effective use for heat and power supply. Geomechanical analysis of the magmatic fracturing regime with seismic data is extremely important for predicting volcanic activity. It is also useful for analyzing the productivity of geothermal reservoirs and as the analog of hydrocarbon reservoirs development with hard-to-recover reserves. The interdisciplinary focus of this workshop will bring together scientists to solve problems which transcend the framework of international borders.

Topics of scientific sessions:

- Hydrothermal systems in volcanic areas
- Seismicity in geofluid volcanic and hydrothermal systems
- Magmatic feeding systems of active volcanoes
- Modeling the natural state and exploitation of geothermal reservoirs in volcanic areas
- Problems of using geothermal energy in volcanic areas for heat and electricity supply
- Magmatic fracturing as an analogue of the development of hydrocarbon reservoirs with hard-to-recover reserves
- Mechanism of geyser functioning and cyclic processes in hydrothermal systems
- Diagenetic alteration of host rocks by hydrothermal fluid circulation

Geothermal Volcanology Workshop 2019 provides a unique opportunity to meet with other scientists working in the Far East segment of the North-West Pacific as it makes an excellent presentation for those willing to participate in research of this unique region, will combine the efforts of scientists for geothermal energy research in the areas of modern volcanism.

Language of the Workshop – English\Russian

Program Organizing Committee:

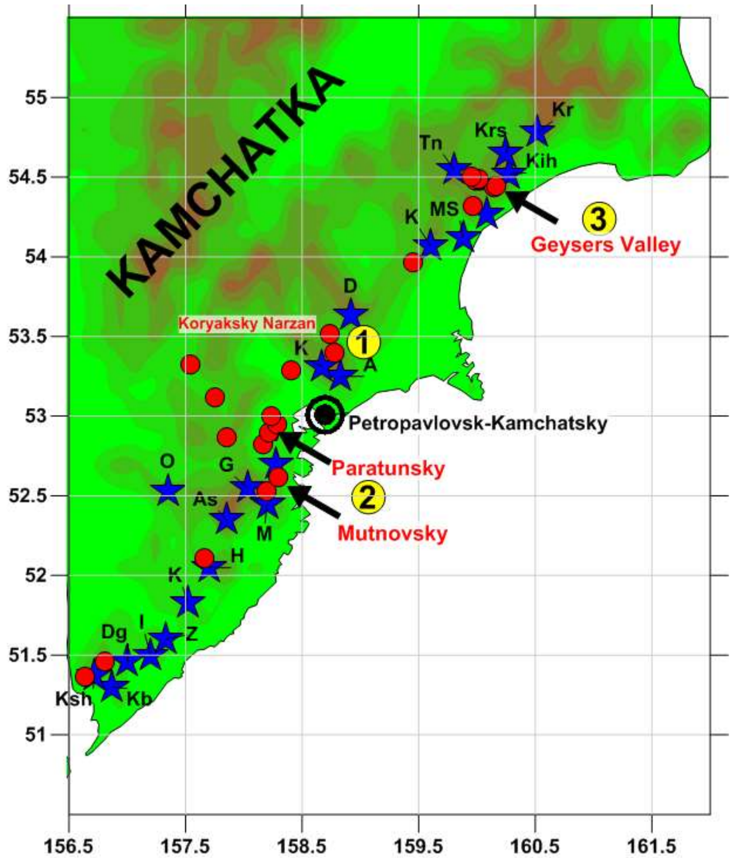
A.V. Kiryukhin (IVS FEB RAS) (Chair), S. Hurwitz (USGS, USA), G.A. Karpov (IVS FEB RAS), S. Klarner (Klarenco LLC, Germany), G.N Kopylova (KB EGS EAS), T. Korovina (JSC «Coretest Services», Tyumen), D. Nielson (DOSECC, USA), I.F. Delemen (IVS FEB RAS*).*

Technical Organizing Committee:
A.V. Kiryukhin (Chair), E.G. Kalacheva, O.E. Bograd, O.A. Evdokimova, S.V. Boldina, A.Yu. Polyakov, I.F. Delemen, P.O. Voronin, A.V. Solomatin, T.B. Rychkova, N.G. Belyakova, N.B. Zhuravlev, S.D. Chernyshov, E.V. Chernykh, S.V. Leshenko.

Meeting format:
Oral (including invited), no more than one from the meeting participant.

Location:
Institute of Volcanology and Seismology FEB RAS, Piip 9 Petropavlovsk-Kamchatsky, Russia.

Field Trips: (1) Avachinsky Volcano and Koryaksky Volcano's Dyke Fields & Thermal Mineral Springs, (2) Mutnovsky & Paratunsky Geothermal Areas, (3) Valley of Geysers, (4) Dykes of the Lagernaya Bay & Pacific Ocean Beach (P-Kamchatsky).



(1) Avachinsky Volcano & Koryaksky Volcano's Dyke Fields & Thermal Mineral Springs

The field trip lasts 14 hours (from 9-00 to 21-00). Number of participants is up to 40. Transport (car+walk), map and route points (Figure 1): IVS FEB RAS – Avachinsky Base /IVS Base (AVH) – trekking (4 hr) to Avachinsky Volcano summit (2100 masl) – ascending (3 hr) to Avachinsky Volcano Cone (2750 masl) – descending (4 hr) to Avachinsky Base (AVH) – IVS FEB RAS. 2 meals stop (lunchbox + tea). Price 4 000 rubles per one participant. Prepayment on registration desk on Sept. 4th 2019 in IVS FEB RAS.

Optional trip on helicopter Robinson 44. Number of participants is up to 10. Flight route (1 hr) - Avachinsky Base /IVS Base (AVH) - Dyke field on the south slope of Koryaksky volcano – Koryaksky Narzan (K8) – Koryaksky Narzan (K2) – Koryaksky Narzan (K1) – Isotovsky Hot Spring (IS) - Avachinsky Base (AVH). The trip costs 22 000 rubles/per one helicopter hr /per one participant. Prepayment on registration desk on Sept. 4th 2019 in IVS FEBRAS.

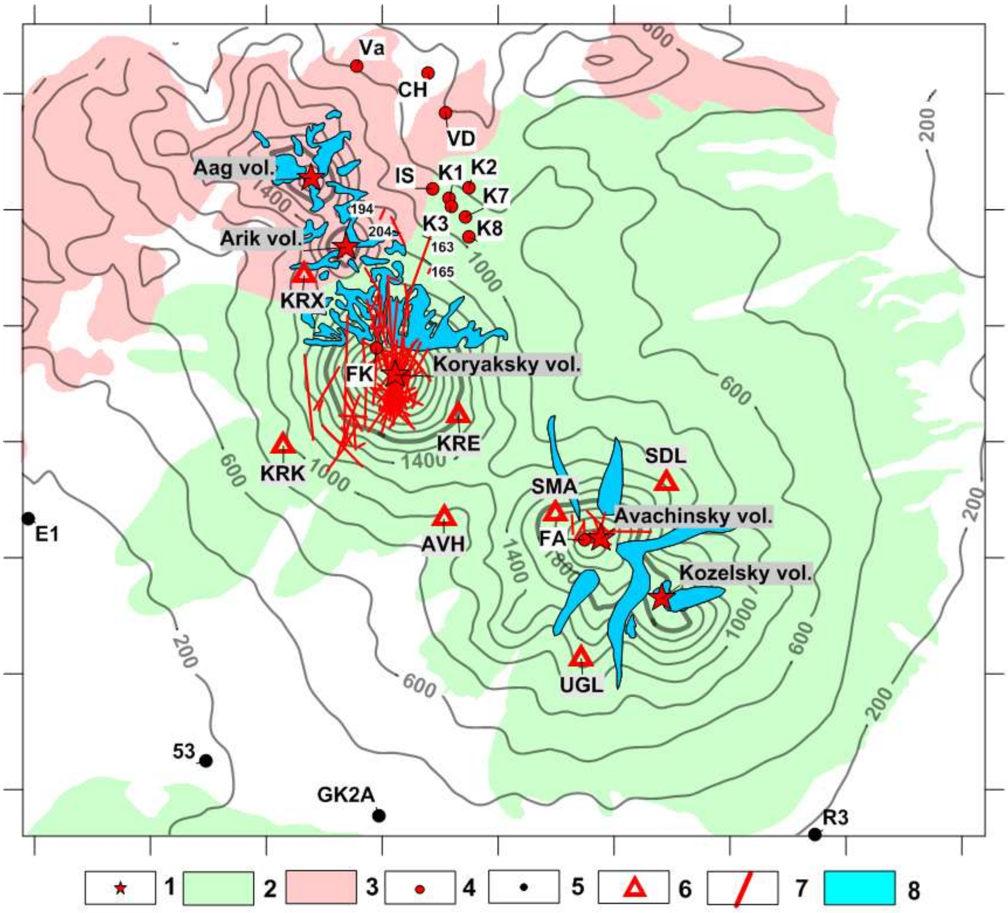


Figure 1 Geological map of the Koryaksky–Avachinsky volcanogenic basin. Legend: (1) The summits of the Avachinsky, Koryaksky, Kozelsky, Arik, and Aag volcanoes; (2) Avachinsky, Koryaksky, Kozelsky volcanoes and their eruptive products; (3) Pinachevsky extrusions Q_{2-3}; (4) thermal features (for details, see Table 1): FA - fumaroles on Avacha Volcano; FK - fumaroles on Koryaksky Volcano; K1, K2, K3, K7, K8 - thermal mineral springs of Koryaksky Narzan; IS - Izotovsky; VD - Vodopadny; CH - Chistinsky; Va - Vakinsky; (5) deep hydrogeological wells; (6) KB GS RAS seismograph stations; (7) dykes traced at -3000 masl below Koryaksky Volcano and 1500 masl below Avachinsky Volcano; (8) glaciers. Note: The isolines show the topographic surface, and the ticks along the axes represent intervals of 5 km.

The Avachinsky-Koryaksky volcanogenic basin (Figure 1), which has an area of 2530 km^2, is located 25 km from Petropavlovsk-Kamchatsky City and includes five Quaternary volcanoes (two of which, Avachinsky (2750 masl) and Koryaksky (3456 masl), are active), and is located within a depression that has formed atop Cretaceous basement rocks. Magma injection zones (dykes and chamber-like shapes) are defined by plane-oriented clusters of local earthquakes that occur during volcanic activity (mostly in 2008-2011) below Koryaksky and Avachinsky volcanoes at depths ranging from -4.0 to -2.0 km and +1.0 to +2.0 km, respectively. Water isotopic (δD, $\delta^{18}O$) data indicate that these volcanoes act as recharge areas for their adjacent thermal mineral springs (Koryaksky Narzans, Isotovsky and Pinachevsky) and the wells of the Bystrinsky and Elizovo aquifers. Carbon $\delta^{13}C$ data in CO_2 from CO_2 springs in the northern foothills of Koryaksky Volcano reflect the magmatic origin of CO_2. Carbon $\delta^{13}C$ data in methane CH_4 reservoirs penetrated by wells in the Neogene-Quaternary layer around Koryaksky and Avachinsky volcanoes indicate the thermobiogenic origin of methane.

Ref:
A. Kiryukhin, V. Lavrushin, P. Kiryukhin, P. Voronin "Geofluid Systems of Koryaksky-Avachinsky Volcanoes (Kamchatka, Russia)," Geofluids, vol. 2017, Article ID 4279652, 21 pages, 2017. doi:10.1155/2017/4279652

(2) Mutnovsky and Paratunsky Geothermal Areas

The field trip lasts 14 hours (from 9-00 to 21-00). Number of participants is up to 40. Transport (car+walk), map and route points (Figures 2 & 3): IVS FEB RAS – V-Paratunsky hot springs – IVS FEB RAS (track-car); V-Paratunsky hot springs – Vilyuchinsky Volcano – Gorely Volcano caldera – Dyke Fields at the entrance to Mutnovsky Volcano Crater (3) – Mutnovsky Volcano Crater and Active Funnel – Volcannaya river/Waterfall 60 m – IVS FEB RAS. 2 meals stop (lunchbox + tea). Price 4 000 rubles per one participant. Prepayment on registration desk on Sept. 4th 2019 in IVS FEB RAS.

Optional trip on helicopter Robinson 44. Number of participants is up to 10. Flight route (1.5 hr) – Nikolaevka airport - V-Paratunsky hot springs – Vilyuchinsky Volcano – N-Zhirovskoy hot spring (16) – Voynovsky hot spring (16) – V-Mutovsky GeoPP 12 MWe – Mutnovsky GeoPP 50 MWe – Dachny Steam Jets (7) – Dyke Field in Mutnovsky Volcano Crater (3) – Vulcannaya River Waterfall 60 m – Cold Springs in Gorely Volcano - Nikolayevka airport. The trip costs 22 000 rubles/per one helicopter hr /per one participant. Prepayment on registration desk on Sept. 4th 2019 in IVS FEBRAS.

The Mutnovsky geothermal area is part of the Eastern Kamchatka active volcano belt. Mutnovsky, 80 kY old and an aging strato-volcano (a complex of 4 composite volcanic cones), acts as a magma- and water-injector into the 25-km-long North Mutnovsky extension zone (Figure 2). Magmatic injection events (dykes) are associated with plane-oriented MEQ (Micro Earth Quakes) clusters, most of them occurring in the NE sector of the volcano (2 x 10 km^2) at elevations from -4 to -2 km, while some magmatic injections occur at elevations from -6.0 to -4.0 km below the Mutnovsky production field. Water recharge of production reservoirs is from the Mutnovsky volcano crater glacier (+1500 to +1800 masl), which was confirmed by water isotopic data (δD, $\delta^{18}O$) of production wells at an earlier stage of development. The Mutnovsky (Dachny) 260-310°C high-temperature production geothermal reservoir with a volume of 16 km^3 is at the junction of NNE- and NE-striking normal faults, which coincides with the current dominant dyke injection orientation. TOUGH2-modeling estimates of the reservoir properties are as follows: the reservoir permeability is 90-600 e-15 m^2, the deep upflow recharge is 80 kg/s and the enthalpy is 1420 kJ/kg. Modeling showed that the reservoir is capable of yielding 65-83 MWe of sustainable production until 2055, if additional production drilling in the SE part of the field is performed. Moreover, this power value may increase to 87-105 MWe if binary technologies are applied.

Modeling also shows that the predicted power is sensitive to local meteoric water influx during development. Conceptual iTOUGH2-EOS1sc thermal hydrodynamic modeling of the Mutnovsky magma-hydrothermal system as a whole reasonably explains its evolution over the last 1500-5000 years in terms of heat recharge (dyke injection from the Mutnovsky-4 funnel) and mass recharge (water injection through the Mutnovsky-2 and Mutnovsky-3 funnels) conditions as previously mentioned.

Ref:

*Selyangin, O. B. To the Mutnovsky and Gorely Volcanoes **:** Volcanological and Tourist Guidebook "New Book **",** 2009. 108 p.*

Kiryukhin A.V., Polyakov A.Y., Usacheva O.O., Kiryukhin P.A. THERMAL-PERMEABILITY STRUCTURE AND RECHARGE CONDITIONS OF THE MUTNOVSKY HIGH TEMPERATURE GEOTHERMAL FIELD (KAMCHATKA, RUSSIA) // Journal of Volcanology and Geothermal Research 356C (2018) pp. 36-55. DOI: 10.1016/j.jvolgeores.2018.02.010

The Paratunsky low temperature geothermal field (Figure 3) has been operating since 1964. During the period of exploitation from 1966-2014, 321 Mt of thermal water (Cl-Na, Cl-SO_4-Na composition, M up to 2600 ppm) with temperatures of 70-100^oC was extracted and used for district heating, balneology and greenhouses. The structure of the 40 km^3 Paratunsky low temperature (80-110°C) geothermal volcanogenic reservoir was geometrically characterized, hot water upflow regions and the 3D permeability distribution were identified with hydrogeological data, and the distribution of the feed zones and 3D temperatures were constrained by 3D spline approximation. Water isotope and gas (N_2, 96-98%) data analysis indicated that the main recharge region of the Paratunsky geothermal reservoirs is the Viluychinsky Volcano (2173 masl) and adjacent highly elevated structures, located 10-25 km south from the geothermal field. Production zones occur in the condition of radial extension, possibly caused by magmatic origin heat sources below the reservoir and hydraulic fracturing possibly caused by the elevated position of the Viluychinsky Volcano's recharge region.

TOUGH2 modeling of the thermo-hydrodynamic natural state and the history of exploitation (involving pressure, temperature and chemical changes response to utilization) between 1965 and 2014 yield estimates of hot water upflow rates (190 kg/s), the production reservoir compressibility (up to 4×10^{-8} Pa^{-1}) and permeability (up to 1.4 D). Modeling confirmed areal discharge of the thermal water from the production reservoir in the top groundwater aquifer (top Dirichlet boundary conditions). Modeling of the chemical (Cl-) history of exploitation provides an explanation of gradual Cl- accumulation due to the inflow of chloride-containing water through the eastern (open) boundary of the geothermal reservoirs. Modeling of the long-term exploitation until 2040 with an exploitation load of 256 kg/s merely shows a low pressure drop (0.7 bars) and an insignificant drop of temperatures in the production geothermal reservoir of the Paratunsky geothermal field.

Ref:

Kiryukhin A.V., Vorozheikina L.A.,Voronin P.O., Kiryukhin P.A. THERMAL-PERMEABILITY STRUCTURE AND RECHARGE CONDITIONS OF THE LOW TEMPERATURE PARATUNSKY GEOTHERMAL RESERVOIRS, KAMCHATKA, RUSSIA // Geothermics 70 (2017) 47–61.

Kiryukhin A. V., Zhuravlev N. B. Using the Paratunsky Geothermal Field to Provide Heating for Kamchatka // Journal of Volcanology and Seismology, 2019, Vol. 13, No. 2, pp. 85–95.

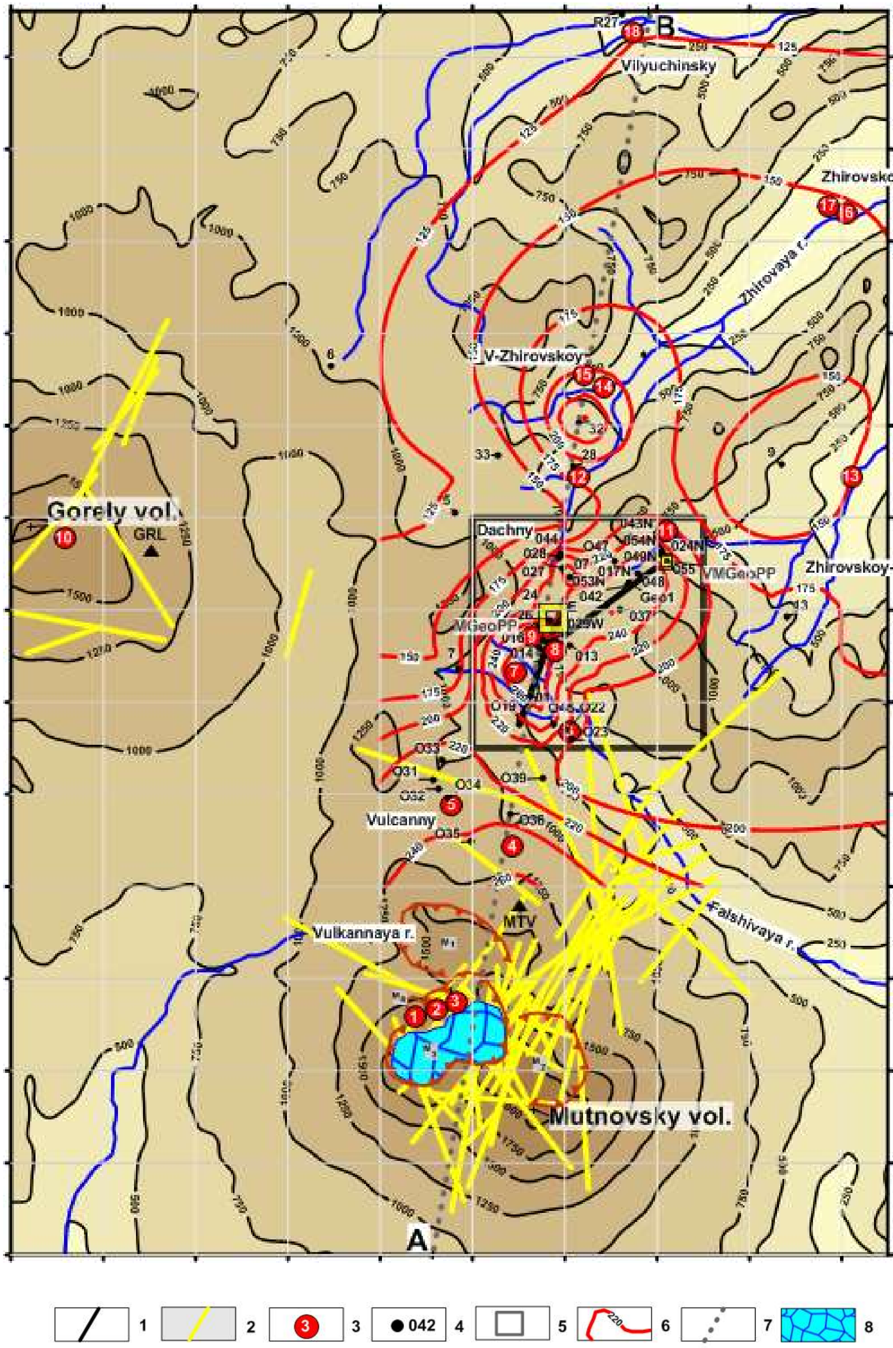


Figure 2. Schematic map and topography of the Mutnovsky geothermal area, grid scale 1 km.

Legend: 1 – Production 2D plane zone traces at -250 masl; 2 – Magmatic injection (dykes) 2009-2016 traces at -3000 masl; 3 – thermal features (1-18, see below); 4 – wells; 5 – rectangle is a detailed TH model area; 6 – temperature isolines at -250 masl; 7 – AB – line of cross-section; and 8 – Glacier in the Mutnovsky volcano crater. Note-1: M_1, M_2, M_3, M_4 – funnels of Mutnovsky volcanoes 1, 2, 3 and 4, respectively (see section 2.3 for details). Note-2: MGeoPP – the existing Mutnovsky geothermal power plant 50 MWe installed; VMGeoPP – the existing Verkhne-Mutnovsky geothermal power plant 12 MWe installed; Dachny, Vulcanny, V-Zhirovskoy, Zhirovskoy-1, Zhirovskoy-2, and Vilyuchinsky – the potential sites for additional geothermal electricity production.

Thermal features: 1 – Active funnel, 2- Bottom field, 3- Upper field, 4,5 – North-Mutnovsky East and West, respectively, 6 – New 2003, 7 – Dachny (Active), 8 – Radon spring, 9 - Medveji, 10 – Gorely volcano gas emission jets, 11 – Verkhne-Mutnovsky, 12 – Piratovsky spring, 13 – Voinovsky spring, 14,15 – Verkhne-Zhirovskoy chloride hot springs and fumaroles, respectively, 16,17 – Nizhne-Zhirovskoy chloride hot springs, and 18,19 – Vilyuchinsky chloride hot springs and well R27, respectively.

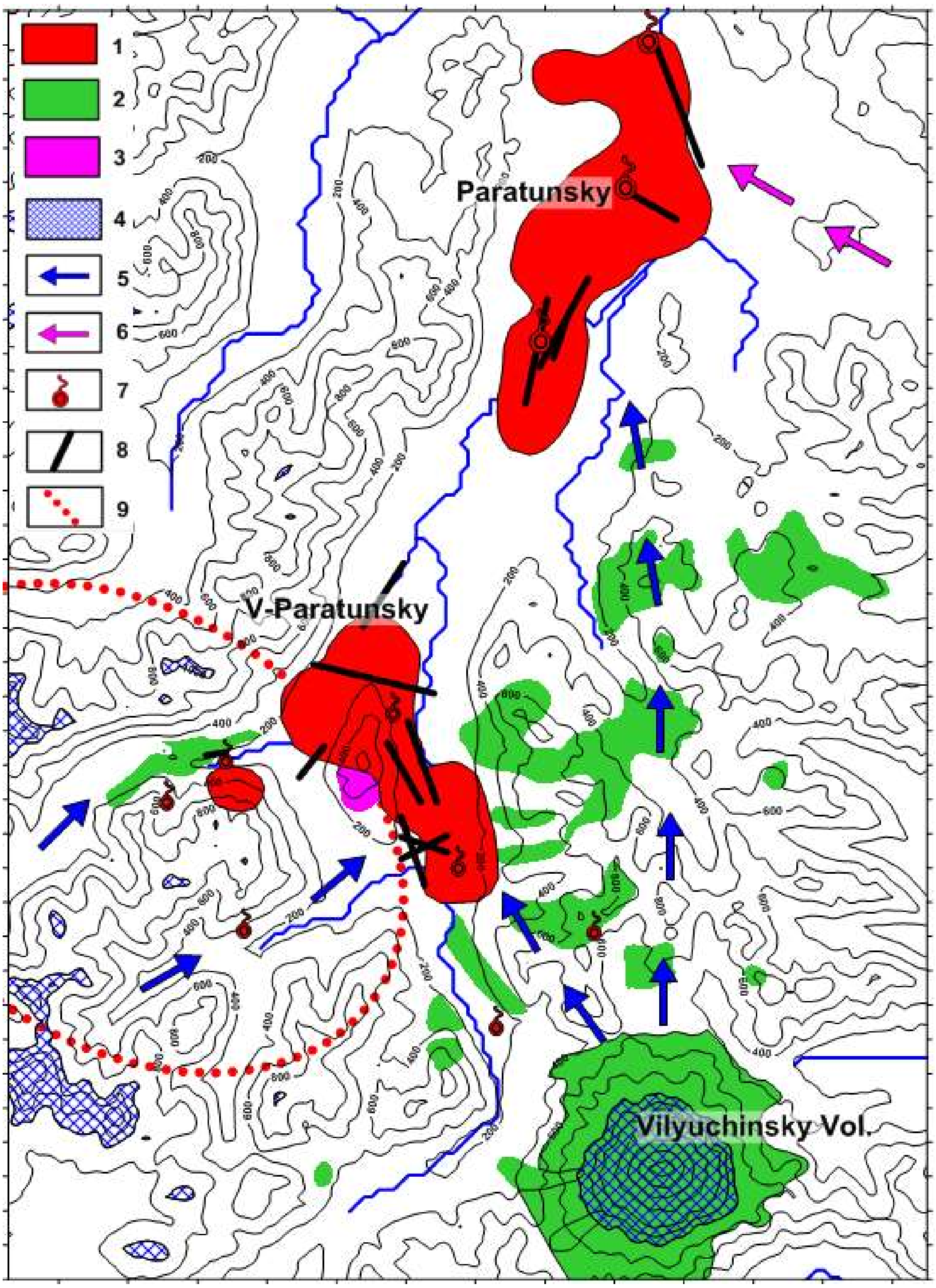


Figure 3 Paratunsky geothermal fields thermo-geo-filtration structure and recharge conditions, topographical elevations in the background, grid scale 1 km.

Legend: 1 – counters of production geothermal reservoirs at -750 masl based on geoisotherm 75°C (Paratunsky) and 60°C (Verkhne-Paratunsky); 2 – Holocene lava flows and cinder cones; 3 – Rhyolite extrusions 0.5-0.8 MY; 4 – water recharge regions for the Paratunsky geothermal reservoirs (with an elevation of more than 1000 masl); 5- Horizontal projections of fluid flows from recharge regions to the production geothermal reservoirs; 6 – Chloride water attracted into the production reservoir due to its exploitation; 7 – Hot springs; 8 – Production zone traces at -750 masl; 9 – Caldera rim 1.2-1.5 MY (Leonov et al., 2007).

(3) Valley of Geysers

The field trip lasts 10 hours (from 9-00 to 21-00). Number of participants is up to 40. Helicopter flights are supported by «Vityaz-Travel» http://vityaz.travel/valley Nikolayevka Airport – Valley of Geysers – Uzon Caldera – Nalychevsky Hot Springs - Nikolayevka Airport. Each group is accompanied by a qualified guide. Hot meals are supplied during this field trip. Swimming in a Nalychevsky hot springs is available. IVS FEB RAS supported transfer to Nikolayevka airport. The trip costs 45 000 rubles per one participant. Prepayment on registration desk on Sept. 4th 2019 in IVS FEBRAS.

The Geysers Valley hydrothermal system (Figure 4) is hosted within a system of two permeable faults (revealed by mapping thermal features), located above a suggested partially melted magmatic body and recharged by meteoric water along the outcrops of rhyolite-dacite extrusions. Fast erosion is stimulating the significant discharge rate and landslide events. The Giant landslide took place on June 3, 2007, when 20×10^6 m^3 of rocks were shifted 2 km downstream, more than 23 geysers were buried or submerged, and Podprudnoe Lake was dammed, injecting cold water into submerged geysers. Possible triggers of the Giant Landslide include the inclination of the sliding plane towards the Geysernaya river basin, a pressure increase in the fluid-magma system, hanging block saturation by water during spring flooding, hydrothermal alteration weakening of the sliding plane, and steam explosions.

The monitoring of the Velikan and Bolshoy geysers after the catastrophic landslide on 3.06.2007 (which dammed and created Podprudnoe Lake, drowning some geysers) and before a mudflow on 3.01.2014 (which destroyed the dam and almost completely drained Podprudnoe Lake) shows that the interval between eruptions (IBE) of the Bolshoy Geyser decreased from 108 to 63 min and that the IBE of the Velikan Geyser slowly declined over three years from 379 min to 335 min. The seasonal hydrological cycle of the Velikan Geyser shows an increase in the IBE during winter (average of 41 min). The dilution of the chloride deep components of the Bolshoy (-17%) and Velikan Geysers (-12%) is also observed. A local TOUGH2 model of the Velikan geyser is developed and is successfully calibrated against temperature observations at both the mid-height and base of the conduit of the Velikan Geyser, which shows the essential role of the CO_2 in the functionality of the geyser. A reservoir model of shallow production geysers is also developed. This 2D model is used to describe changes in the thermal hydrodynamic state and evolving chloride concentrations in the areas of most prominent discharge, both at steady state and when perturbed by cold water injection from Podprudnoe Lake and other cold water sources (after 3.06.2007). A “well on deliverability” option is used to model the geyser discharge features in the model. The modeled increases in geyser discharge that is caused by an increase in the reservoir pressure from cold water injection reasonably matches observations of IBE decreases in the Bolshoy (~58%) and Velikan Geysers (~9%).

1941-2017 period of the Valley of Geysers monitoring (Kamchatka, Kronotsky Reserve) reveals a very dynamic geyser behavior under natural state conditions: significant changes of IBE (interval between eruptions) and power of eruptions, chloride and other chemical components, and pre-eruption bottom temperature. Nevertheless, the total deep thermal water discharge remains relatively stable, thus all of the changes are caused by redistribution of the thermal discharge due to Giant Landslide of June 3, 2007, Mudflow of Jan. 3, 2014 and other events of geothermal caprock erosion and water injection into the geothermal reservoir. Temperature logging in geysers Velikan (1994, 2007, 2015, 2016, 2017) and Bolshoy (2015, 2016, 2017) conduits shows pre-eruption temperatures below boiling at corresponding hydrostatic pressure, that means partial pressure of CO_2 creates gas-lift upflow conditions in geyser conduits. Velikan geyser IBE history explained in terms of gradual CO_2 recharge decline (1941-2013), followed by CO_2 recharge significant dilution after the mudflow of Jan. 3, 2014 also reshaped geyser conduit and diminished its fountain height.

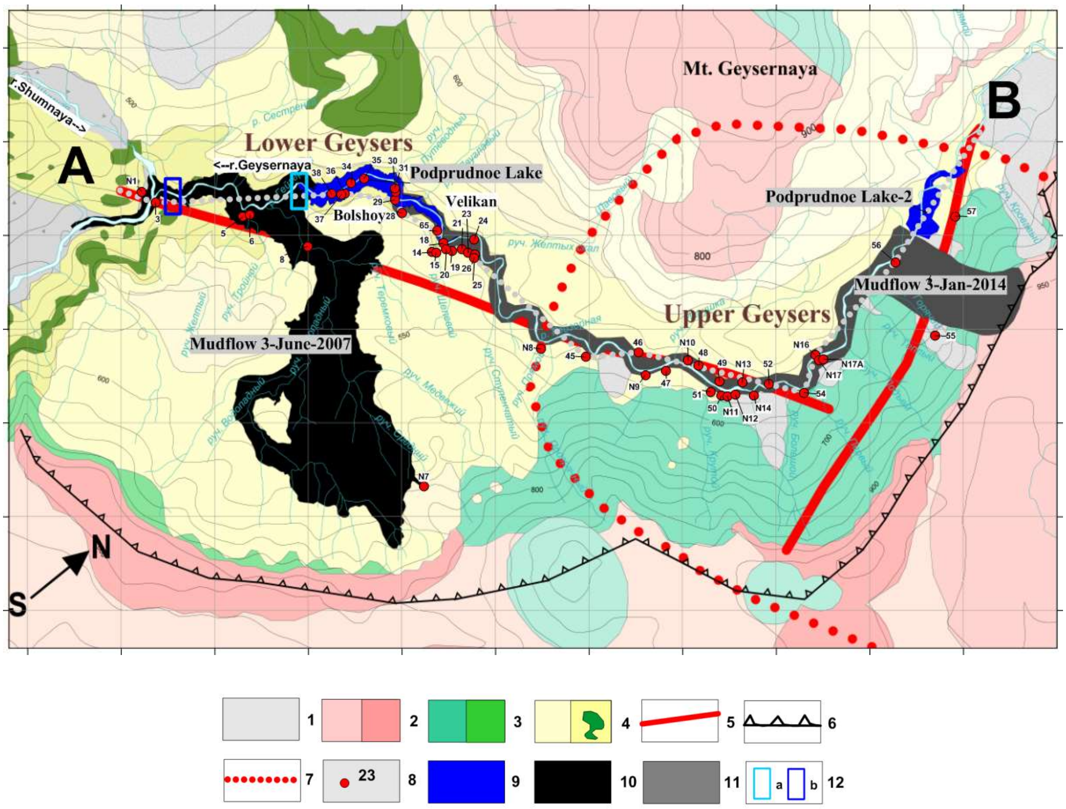


Figure 4 Schematic map of the Valley of Geysers. Legend: 1 - Alluvial and glacial deposits Q_{3-4}; 2 - permeable units of rhyolite, dacite and andesite extrusions ($\alpha\xi Q_3^4$); 3 - basalt, andesite, and dacite lavas and pyroclastics (αQ_3^{1-2}); 4 –low permeability units of caldera lake deposits (Q_3^4), which are complicated by a dyke complex (Q_3^3ust); 5 – assumed thermal fluid-conducting faults; 6 – Uzon-Geysernaya caldera boundary; 7 - uplifted area that is associated with the contours of the active magma reservoir (Lundgren et al., 2006); 8 - geysers and hot springs (for numeration, see Table 6 in Kiryukhin, 2016); 9 - Podprudnoe Lake and Podprudnoe Lake-2 dumb by mudflows; 10 - catastrophic landslide-mudflow on 3.06.2007; 11 - landslide-mudflow on 3.01.2014; 12 – Geysernaya river flow rate measurement points: a – Podprudnoe Lake exit, b – Geysernaya river mouth. Grid scale – 500 m. AB – grey dotted line of cross-section.

Ref:

Sugrobov, V.M., Sugrobova, N.G., Droznin, V.A., Karpov, G.A., Leonov, V.L., 2009. The Valley of Geysers — The Pearl of Kamchatka (Scientific Guide). Kamchatpress, Petropavlovsk-Kamchatsky (108 p.).

A.V. Kiryukhin, T.V. Rychkova, I.K. Dubrovskaya Hydrothermal system in Geysers Valley (Kamchatka) and triggers of the Giant landslide // Applied Geochemistry Journal, Applied Geochemistry 27 (2012) 1753–1766

A. Kiryukhin. Modeling and observations of geyser activity in relation to catastrophic landslides–mudflows (Kronotsky nature reserve, Kamchatka, Russia). Journal of Volcanology and Geothermal Research, 323, p. 129-147, 2016.

A. Kiryukhin, V. Sugrobov, E. Sonnenthal. Geysers Valley CO_2 Cycling geological Engine (Kamchatka, Russia) // Geofluids Journal, 2018, 17 p. *https://www.hindawi.com/journals/geofluids/aip/1963618/*

(4) Volcanological Museum of the Institute of Volcanology & Seismology FEB RAS

One hour during September 5th 2019 (time TBD).

Transport:
Daily flights between Moscow and Petropavlovsk-Kamchatsky, frequent flights from, Khabarovsk and Vladivostok. Participants from the US west coast can take the following routes to Petropavlovsk-Kamchatsky. **This summer, Yakutia Airlines flights operate on the route Anchorage-Petropavlovsk on Sundays, 18AUG, 25AUG and 01SEP (the ANC-PKC flight arrives Petropavlovsk on Monday); they arrive and depart Anchorage early morning (ARR 5:40, DEP 7:30). From the US West Coast to Anchorage there are many flights every day, most on Alaska Airlines. Most travelers taking the Anchorage-Petropavlovsk flight prefer to arrive in Anchorage one day prior and overnight in a hotel, while some choose to take a "red-eye" overnight flight to Anchorage.**

Weather:
The beginning of September in Petropavlovsk-Kamchatsky is usually sunny with a temperature of +16 °C, but the possibility of a rain is not ruled out.

Cost:
Workshop registration fee: 3000 rub. (includes the expenses for organization and conducting of the workshop and general events).

Accommodation: Hotels "Edelweiss", "Petropavlovsk", "Avacha" and "Oktyabrskaya". The most inexpensive rooms (about $ 100) are in the hotel "Edelweiss", which is located near the Institute of Volcanology and Seismology FEB RAS.

Support: Workshop supported by Russian Foundation for Basic Research (RFBR). The organizers expect support from the Russian Foundation for Scientific Research (RSF), JSC Teplo Zemli, JSC Geotherm, International Geothermal Association (IGA), ICDP (International Continental Drilling Program), PJSC Gazpromneft .

For all questions concerning the organization of the meeting, contact Tatiana Rychkova and Evgenia Chernykh **GeothermalVolcanology2019@gmail.com**

Follow the updates on the website of IVS FEB RAS: http://www.kscnet.ru/ivs/.

Abstracts

Abstract submission is until **June 15, 2019**.
Abstract submissions should be 0.5 page or less, 12 point Times New Roman, 1-inch margins, and include title, author(s), author(s) affiliation, author(s) email, and abstract text. Please do not include any graphics.
Please submit your abstract via e-mail **GeothermalVolcanology2019@gmail.com**

Abstracts will be reviewed with regard to scientific quality and suitability for the conference.
Accepted abstracts will be designated for either oral or poster presentation at the discretion of the organizing committee; authors with a preference for poster presentation should note this on the online submission form.
Each presenting author is generally allowed to present one paper or poster as a first author at the conference; multiple presentations will be dependent on the available program space.
The notification of acceptance of abstracts will be sent by **June 15, 2019**.

Extended Abstracts

FORMAT and LENGTH: Extended Abstracts **should be 4 pages**, 12 point Times New Roman, 1-inch margins, and include title, author(s), author(s) affiliation, author(s) email, and abstract text. This length includes all figures, tables and references.
The due date for submitting extended abstracts will be **August 1, 2019**.
Template of abstracts for materials of the Geothermal Volcanology Workshop 2019

Presentations PPT

SUBMIT your presentation to **GeothermalVolcanology2019@gmail.com**
no later than September, 2nd 2019.
DOCUMENT NAME for your file upload: *Last name_First word of Session name_First 4-5 words of Title_version #* (EXAMPLE: Prieto_Geologic_Giving a presentation on the_v3)
TIME ALLOTTED for Oral Presentations: 20 minutes total (13 minutes talk + 5 minutes for discussion + 2 minutes for changeover between speakers)

Schedule of the GVW-2019 and Field Trips

Date	Event	Time & Place
September, 4th 2019	**Registration**	**IVS FEBRAS, room 215, 9:00 -18:00**
September, 5-6th 2019	**Registration (continues) Technical Sessions**	**IVS FEBRAS, Large Conference Hall,9:00 -18:00**
September, 7th 2019	**Field trip 1**	**Avachinsky Volcano & Koryaksky Volcano's Dyke Fields and Thermal Mineral Springs , 7:00 – 21:00**
September, 8th 2019	**Field trip 2**	**Mutnovsky & Paratunsky Geothermal Areas, 7:00 – 21:00**
September, 9th 2019	**Field trip 3**	**Valley of Geysers, 9:00 – 19:00**