

Ten Big News Items



Institute for Geo-Resources and Environment

Ten Big News Items 2012



Ten Big News Items from the Institute for Geo-Resources and Environment

Our research focuses on three major areas central to ensuring the sustainable development of society: (1) utilization of the geosphere to establish a sustainable and stable energy cycle, (2) protection of the geosphere for the safety and health of the nation, and (3) procurement of a stable supply of natural resources for industrial activities and society at large. Ten Big News Items of 2012 were selected from projects carried out at our institute over the past year that have the most potential to contribute to the achievement of sustainable development, based on the following factors:

- Noteworthy research results
- Launch, continued implementation, or completion of an important project or joint research
- Contribution to society through the publication of research results or through technology transfer
- Creation of an important knowledge base or basic research results
- Events, awards, etc. that bring honor to the Institute
- Important initiatives taken by the Institute that lead to advances in its research

The Great East Japan Earthquake caused catastrophic damage to Japan. The tsunami that followed the earthquake took the lives of thousands of people, and the subsequent nuclear power plant accident brought about lingering anxiety and long-term suffering. The facilities of GREEN have almost fully recovered, and the research staff of the West site of AIST have been transferred to the site 7. In the time since the earthquake, we have taken actions to increase our renewable energy supply, including geothermal energy and geothermal heat pump systems, at the new GREEN site in Fukushima. This bulletin consists of ten news items relating to the earthquake disaster as well as ongoing research projects and other important news items.

I hope that this brochure will help you in understanding the activities and contributions of our institute.

March 2013
Dr. Takeshi Komai, Director

Ten Big News Items 2012

Title	Research group and Researchers
● NISTEP Award 2012 given for public communications on geothermal energy	Kasumi Yasukawa (Geo-Analysis R.G.)
● Discovery of a rare-earth deposit in the Republic of South Africa	Mineral Resources R.G. and Yasushi Watanabe
● Predicting oil and gas reservoir quality from the geometry of submarine levees	Takeshi Nakajima (Fuel Resource Geology R.G.)
● Rapid measurement of radiocesium in water using Prussian blue	Tetsuo Yasutaka, Yoshishige Kawabe, Yasuhide Sakamoto, Ming Zhang (Geo-Environmental Risk R.G.)
● Laboratory study of methane production by subsurface microbes	Hideyoshi Yoshioka, Taiki Katayama, Daisuke Mayumi, Mio Takeuchi, Hanako Mochimaru, Susumu Sakata, (Geomicrobiology R.G.)
● Research progress and promotion activities of groundwater flow and heat pump systems	Mayumi Yoshioka and Youhei Uchida (Groundwater R.G.)
● Research and outreach on geothermal energy and hot springs	Geothermal Resources R.G. and collaborators
● International research on CO ₂ geological storage	CO ₂ Geological Storage R.G. and collaborators
● Publication of Geochemical and Risk Assessment Map of Subsurface Soils -Toyama Prefecture-	Junko Hara and Yoshishige Kawabe (Geo-Environment Risk R.G.) and Takeshi Komai
● Cooperative studies of earthquake liquefaction and groundwater contamination	Exploration Geophysics R.G., Quaternary Basin R.G. and Geophysics R.G. (Institute of Geology and Geoinformation)

NISTEP Award 2012 given for public communications on geothermal energy

Kasumi Yasukawa (Geo-Analysis R.G.)

[Outline]

The National Institute of Science and Technology Policy (NISTEP) selected Kasumi Yasukawa as one of 11 NISTEP Researchers Award winners in 2012 for her public communication activities on geothermal energy.

[Details]

Geothermal development is expanding worldwide as a clean and stable power source. However, although Japan has a high geothermal potential, new facilities not been developed here for a decade. The major reasons are not geological but social: most resources are located in national parks, the permit process is lengthy, and hot-spring owners have serious concerns. To address these concerns, the Geothermal Research Society of Japan has added public-information activities to its original technical meetings. Kasumi Yasukawa has led many of these, including forums and publications for citizens and officials. These activities helped trigger changes in geothermal policy in 2012, after nuclear power plant accidents resulted in more favorable regulations and increased feed-in tariffs for geothermal power. Several geothermal prospects being surveyed by public agencies are to be developed with government support. NISTEP has given its Researchers Award since 2005 to research scientists with outstanding work in various fields.

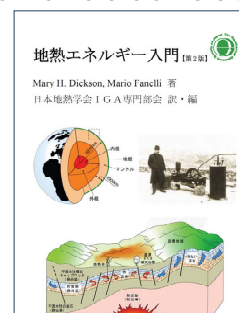
[Future expectations]

Hakubun Shimomura, head of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), presenting the award on 25 January 2013, noted that 2012 Nobel Prize winner Dr. Shinya Yamanaka won a NISTEP Award in 2006 and said, "I hope to see not one but several of you get Nobel prizes in the future."

Contact: Kasumi Yasukawa, E-mail: kasumi-yasukawa@aist.go.jp, Phone: +81-29-861-3280



2012 NISTEP Researchers Award winners flank MEXT head Shimomura and Senior Vice Minister Teru Fukui. Kasumi Yasukawa stands fifth from the left in the back row.



Japanese version of "What is geothermal energy?" translated and edited by Kasumi Yasukawa and company in the Geothermal Research Society of Japan.
(<http://grsj.gr.jp/whatbook/>)

Discovery of a rare-earth deposit in the Republic of South Africa

Mineral Resources R.G. and Yasushi Watanabe

[Outline]

We discovered a promising rare-earth (RE) deposit in the northeastern part of the Republic of South Africa during a joint study with the Council for Geoscience, South Africa.

[Details]

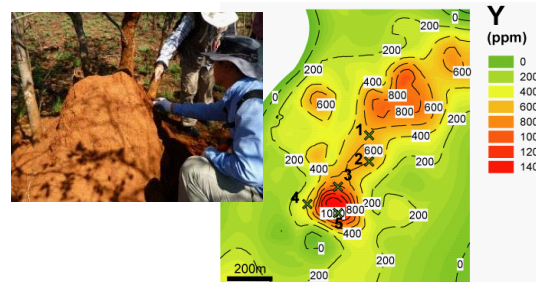
In a project funded by the Ministry of Economy, Trade and Industry, we conducted a drilling survey in a RE prospect found by our previous survey in 2009. We found excellent RE mineralization in the area's alkaline igneous rocks, contained mainly in zirconium silicates and characterized by compositions enriched in heavy RE elements and yttrium. Chemical evidence from drill cores and anthill sediments indicates that the mineralized area extends 300 m × 1 km and is more than 100 m deep. Thick weathering crusts enriched in RE were formed near the surface. The deposit is favorably located for mining in a flat and easily accessible area.

[Application of research results]

This study helps secure and diversify heavy RE sources outside of China. The joint study with the South African agency enables us to make valuable personal contacts and obtain information on mineral resources in southern Africa.



Drilling survey in South Africa.



Geochemical survey of anthills.

Contact: Tetsuichi Takagi, E-mail: takagi-t@aist.go.jp, Phone: +81-29-861-3926

Predicting oil and gas reservoir quality from the geometry of submarine levees

Takeshi Nakajima (Fuel Resource Geology R.G.)

【Outline】

By analyses of submarine levees formed by turbidity currents, we showed that their geometry is closely tied to submarine slopes and sediment grain size.

【Details】

Quantitative analysis of the geometry of six submarine levees from around the world showed that levee thicknesses exhibit power-law decay with distance away from parent channels on steep slopes ($>0.6^\circ$) but exponential decay on gentle slopes ($<0.6^\circ$). We surmise that this difference is related to how efficiently seawater is mixed into turbidity currents on different slopes. We also found that the relationship between the levee geometry and slopes is influenced by the grain size of the levee sediments.

- Nakajima, T. and Kneller, B.C. (2012) Quantitative analysis of the geometry of submarine external levees. Sedimentology. doi:10.1111/j.1365-3091.2012.01366.x

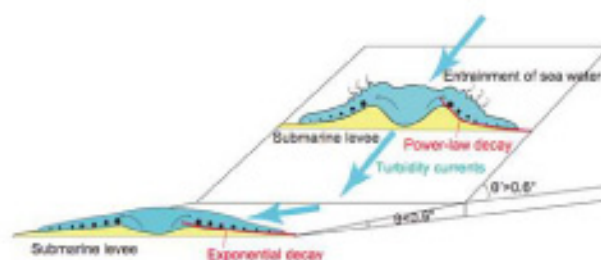
【Application of research results】

Ancient submarine levees in sedimentary sequences often form good oil and gas reservoirs. This study may help in predicting reservoir quality by estimating slope and sediment grain size from the geometry of submarine levees, which can be measured without drilling.

- Collaborator: Ben C. Kneller (University of Aberdeen, UK)



Submarine levee systems analyzed in this study.



Geometry of submarine levees exhibits power-law decay on steep slopes versus exponential decay on gentle slopes.

Contact: Takeshi Nakajima, E-mail: takeshi.nakajima@aist.go.jp, Phone: +81-29-861-3958

Rapid measurement of radiocesium in water using Prussian blue

Tetsuo Yasutaka, Yoshishige Kawabe, Yasuhide Sakamoto, Ming Zhang (Geo-Environmental Risk R.G.)

【Outline】

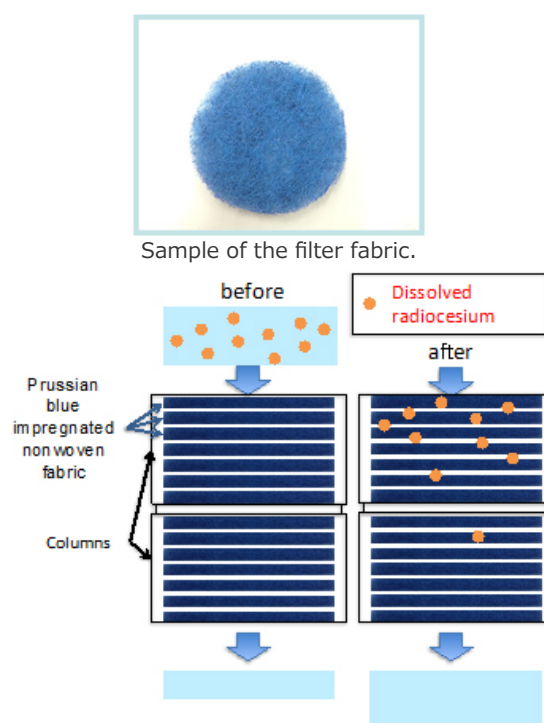
We developed a method for rapidly concentrating and measuring radioactive cesium (radiocesium) in fresh water by using fabric impregnated with the cesium adsorbent Prussian blue.

【Details】

It is important to determine the level of dissolved radiocesium (^{134}Cs and ^{137}Cs) in streams and lakes when forecasting the discharge of these highly radioactive isotopes from forests and watersheds. However, with traditional methods, it takes over 6 hours to filter and concentrate water samples. We developed a much faster method that extracts the dissolved radiocesium from a freshwater sample of 20–100 L in less than 1 hour by passing the water through a series of 10–12 columns fitted with nonwoven fabric disks impregnated with Prussian blue. This iron cyanide compound efficiently adsorbs the radiocesium, which is then measured on the basis of its radioactivity using a germanium gamma-ray detector.

【Application of research results】

We plan to conduct long-term monitoring of dissolved radiocesium in Fukushima Prefecture.



Adsorption of radiocesium onto filters impregnated with Prussian blue.

Contact: Tetsuo Yasutaka, E-mail: t.yasutaka@aist.go.jp, Phone: +81-29-849-1545

Laboratory study of methane production by subsurface microbes

Hideyoshi Yoshioka, Taiki Katayama, Daisuke Mayumi, Mio Takeuchi, Hanako Mochimaru, Susumu Sakata (Geomicrobiology R.G.)

【Outline】

We measured the subsurface microbial activity that produces methane in onshore and offshore oil and gas fields and areas with methane hydrate accumulations. We can now mimic the subsurface environment with a new apparatus that incubates methane-producing microbes at high hydrostatic pressures.

【Details】

Hydrogen-consuming methanogens are abundant in the marine sediments of the eastern Nankai Trough and in formation waters from the Minami Kanto gas field. We demonstrated that methanogenesis occurred during the degradation of crude oil by stimulating microbial activity in incubation experiments that mimic actual reservoir conditions. We constructed a new experimental system for incubating sediments at high hydrostatic pressures to help predict the impact of carbon capture/storage projects on subsurface microbes.

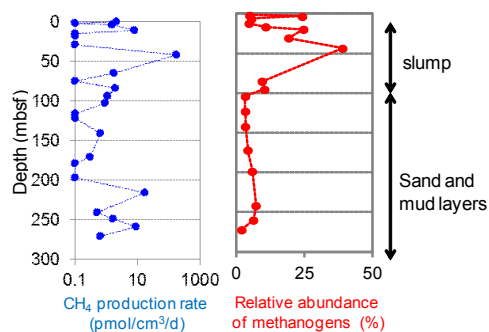
【Application of research results】

Knowledge of microbial methane production helps us explain how methane hydrate accumulations form and makes exploration of oil and gas fields more effective. The new experimental system can help us develop technology for deep carbon storage that utilizes the metabolic functions of subsurface microbes.

【Collaborative research scientists】

H. Tamaki, Y. Kamagata (Bioproduction Research Institute, AIST), M. Amo (Japan Oil, Gas and Metals National Corporation), Y. Muramoto, J. Usami (Kanto Natural Gas Development Co., Ltd.), H. Maeda, T. Wakayama, Y. Miyagawa, M. Ikarashi (INPEX Corporation)

Contact: Susumu Sakata, E-mail: su-sakata@aist.go.jp, Phone: +81-29-861-3898



Activity and distribution of methanogens in marine sediment of the eastern Nankai Trough.



Experimental system for high- pressure incubation (left) and incubation vessel (right).

Research progress and promotion activities of groundwater flow and heat pump systems

Mayumi Yoshioka and Youhei Uchida (Groundwater R.G.)

【Outline】

Two GREEN scientists won prizes for their research on the effective use of heat pump systems under different groundwater conditions.

【Details】

The Geothermal Research Society of Japan presented its annual Best Paper Award to Mayumi Yoshioka and Youhei Uchida for papers they published in 2012. The society also awarded Mayumi Yoshioka its prize to encourage research. The work of these scientists sheds light on the impact of groundwater flow on thermal transportation, which underlies the development of effective heat pump systems.

【Application of research results】

This research will help in bringing about low-cost and high-performance heat pump systems in the near future. Result of the study was widely explained on a visit class and lecture for kids with our articles in the original bag, to expect the understandings and use of next generation.



Award certificates from the Geothermal Research Society of Japan.



Original paper bag used to distribute articles in the disaster area (Haruna Tarusawa received the Encouragement Award of Design Selection of Ibaraki Prefecture).

Contact: Atsunao Marui, E-mail: marui.01@aist.go.jp, Phone: +81-29-861-2382

Research and outreach on geothermal energy and hot springs

Geothermal Resources R.G. and collaborators

【Outline】

Our research has advanced geothermal reservoir management systems and binary-cycle generation systems that are compatible with existing hot springs. We conducted outreach activities to raise public awareness of geothermal energy.

【Details】

We performed the first tracer test in a hot spring area in Japan to reveal its flow mechanisms. We also developed a software package to evaluate the temporal variations in hot spring monitoring data. These will promote geothermal power generation that can coexist with hot springs. We participated in interviews for the mass media and delivered invited lectures on geothermal energy. We created a “Geothermal Game” aimed mainly at schoolchildren and demonstrated it at exhibitions.

【Application of research results】

This work will enhance support for geothermal energy projects that serve local needs without damaging hot springs.



Part of “The ‘Geothermal Game’ board” . Players act as the president of a geothermal development company and choose suitable uses for their hot water.

Contact: Keiichi Sakaguchi, E-mail : k-sakaguchi@aist.go.jp, Phone: +81-29-861-3897

International research on CO₂ geological storage

CO₂ Geological Storage R.G. and collaborators

【Outline】

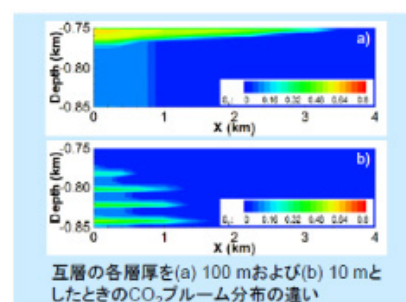
We promoted international cooperation in research on monitoring and modeling technologies related to CO₂ geological storage. One of our researchers received an award from the U.S. Geothermal Resources Council.

【Details】

In cooperation with U.S. research institutes, we participated in a demonstration project and carried out baseline monitoring at an EOR (Enhanced Oil Recovery) test site in the United States. We promoted dissemination of our research results by presenting 12 research papers at the 2012 International Conference on Greenhouse Gas Technologies (GHGT-11) in Kyoto, and by organizing the 5th Joint Workshop with the Korea Institute of Geosciences and Mineral Resources (KIGAM). Dr. Tsuneo Ishido (visiting senior researcher) received a Pioneer Award from the Geothermal Resources Council (GRC) at its annual meeting in the United States for his leading research on coupling of geophysical monitoring and reservoir simulations.

【Application of research results】

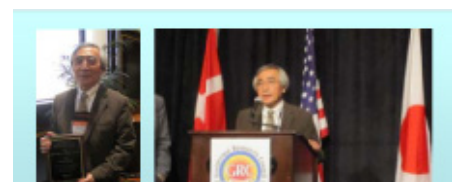
Our research helps in developing effective geophysical monitoring technologies and safety assessments of geologically stored CO₂.



Simulated CO₂ injections into interbedded sandstone and mudstone.



Participants in the 5th Joint Workshop with KIGAM.



Dr. Ishido at the GRC award ceremony.

Contact: Shinsuke Nakao, E-mail : sh-nakao@aist.go.jp, Phone: +81-29-861-3955

Publication of Geochemical and Risk Assessment Map of Subsurface Soils -Toyama Prefecture-

Junko Hara, Yoshisige Kawabe (Geo-Environment Risk R.G.) and Takeshi Komai

【Outline】

Through approaches ranging in scale from the laboratory to the earth's crust, we have obtained and published results associated with the role of fluids in the mechanisms of rock deformation and failure.

【Details】

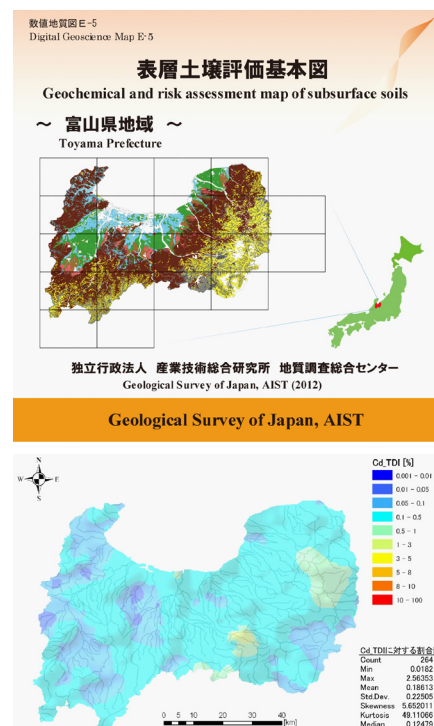
Toyama Prefecture includes igneous and metamorphic rocks in the mountains and Neogene sedimentary rocks and Quaternary sediments in the lowlands. The chemistry of its subsurface soils corresponds to the chemistry of these different source materials. The lower reach of the Jinzu River was formerly the site of many cases of itai-itai disease (cadmium poisoning) due to mining upstream, but our research found that cadmium concentrations in subsurface soils are now below regulatory limits, including the area around the upstream ore deposits and the Funaka region. Soil exposure is now estimated to have no risk for humans from cadmium.

- J. Hara, Y. Kawabe and T. Komai (2012) Geochemical and risk assessment map of subsurface soils -Toyama Prefecture-. Digital Geoscience Map E-5, Geological Survey of Japan, AIST.
- Lei et al.(2009) Physics of the Earth and Planetary Interiors, 176, 224-234.

【Application of research results】

The detailed map of concentration data for various elements is useful for reviewing new land uses or changes in the geochemical background, and it will help in determining the origin of soil pollution.

Contact: Junko Hara, E-mail : j.hara@aist.go.jp, Phone: +81-29-861-8773



Human risk assessment map about Cadmium.

Cooperative studies of earthquake liquefaction and groundwater contamination

Exploration Geophysics R.G.

Quaternary Basin R.G. Geophysics R.G. (Institute of Geology and Geoinformation)

【Outline】

Three different research groups of the Geological Survey of Japan, AIST, jointly carried out investigations related to the earthquake liquefaction, and groundwater contamination that occurred during the East Japan great earthquake disaster.

【Details】

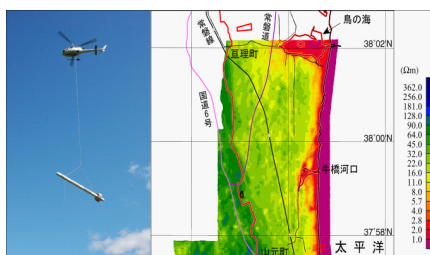
The Exploration Research Group of the Institute of Geo-Resources and Environment, Quaternary Basin and Geophysics Research Groups of the Institute of Geology and Geoinformation jointly carried out various field investigations of liquefaction and groundwater contamination in cooperation with local governments. In the lower part of the Tone River basin, we performed trench excavation and boring surveys, geophysical investigations, and cone penetrometer tests. In the southern part of the Sendai plain, we mapped possible groundwater contamination due to tsunami flooding by conducting an electromagnetic survey using a helicopter-borne sensor. We also carried out more detailed geoelectrical investigations and boring surveys.

【Application of research results】

Our results will be reported to the associated local governments for use as basic data in their restoration and revival plans.



Truck-mounted ground-penetrating radar system for the detection of soft ground zones.



Helicopter-borne electromagnetic exploration system (left) and resistivity map at 140 kHz (right) in the southern Sendai plain. The red line is the limit of the tsunami inundation.

Contact: Yuji Mitsuata, E-mail : y.mitsuata@aist.go.jp, Phone: +81-29-861-2387

Ten Big News Items of the Institute for Geo-Resources and Environment



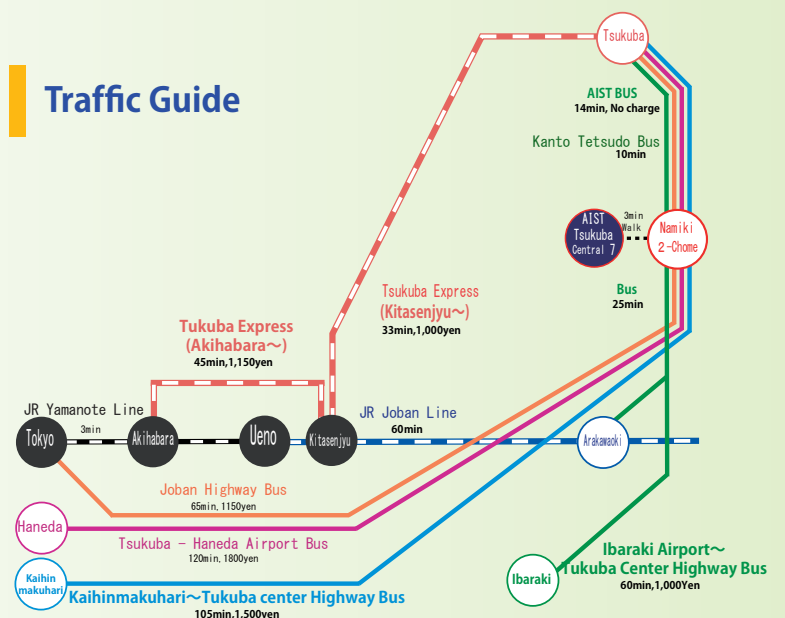
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Dr. Shinsuke Nakao, Director, Research Institute for Geo-Resources and Environment
National Institute of Advanced Industrial Science and Technology (AIST)
Tsukuba Central 7, Tsukuba, Ibaraki 305-8567, Japan
<http://unit.aist.go.jp/georesenv/>



Research Groups

- Groundwater Research Group
- Geothermal Resources Research Group
- Mineral Resources Research Group
- Fuel Resource Geology Research Group
- Geomicrobiology Research Group
- Resource Geochemistry Research Group
- Exploration Geophysics Research Group
- CO2 Geological Storage Research Group
- Geo-Analysis Research Group
- Geo-Environmental Risk Research Group
- Geo-Environmental Systems Research Group

Traffic Guide



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