2014 Annual REPORT

CHINESE ACADEMY OF GEOLOGICAL SCIENCES

Geological Publishing House

SUMMARY

This Annual Report documents the work of the Chinese Academy of Geological Sciences in major aspects of 2014, covering management and supporting services in science and technology, representative research achievements, construction of key laboratories, international collaboration and exchanges, graduate education, and academic publications, and systematically outlines the advances of the Academy in development in the year 2014.

The present work can serve as reference for those who are working and studying in the field of earth sciences or dealing with scientific and technological management as regards land and resources, and also for teachers and students engaged in relevant fields at colleges and universities.

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Editorial Board

Preface

The Annual Report records major scientific and technological accomplishments at the Chinese Academy of Geological Sciences (CAGS) for the year of 2014.

In 2014, all the geoscientists and staff members of the Academy promoted the truth-seeking and pioneering spirit, and forged ahead with determination. Notable progress was made in all our work. Several areas merit special mention in this annual report.

Firstly, fruitful achievements were made in geological survey, and geoscientific research.

Altogether 1193 scientific and technological projects were carried out with a total funding of 1.062 billion Yuan in 2014, of which 266 million Yuan came from support for national scientific and technological funding sources, 737 million Yuan from the China Geological Survey (CGS), and 59 million Yuan from other funding sources. In 2014, 1117 scientific papers were published, including 371 SCI-indexed papers and 114 EI-indexed papers, and 25 monographs were published. In 2014, 12 projects were awarded National Invention Patents, 44 received National Patents for Utility Models, 3 National Patents for Designs, and 16 were awarded with software copyrights. Researches of the Academy received 2 first prizes and 4 second prizes of the Science and Technology Award from the Ministry of Land and Resources (MLR), 4 provincial and ministerial prizes, 4 first prizes and 7 second prizes of the Achievement Award issued by the CGS. 4 research achievements were reviewed as the Top 10 Geological Scientific and Technological Advances by the CGS and CAGS, and 2 were selected as projects in a list of the Top 10 Geological Science and Technology Advances by the Geological Society of China (GSC).

Secondly, new advances were achieved in key geoscientific research and geological surveys.

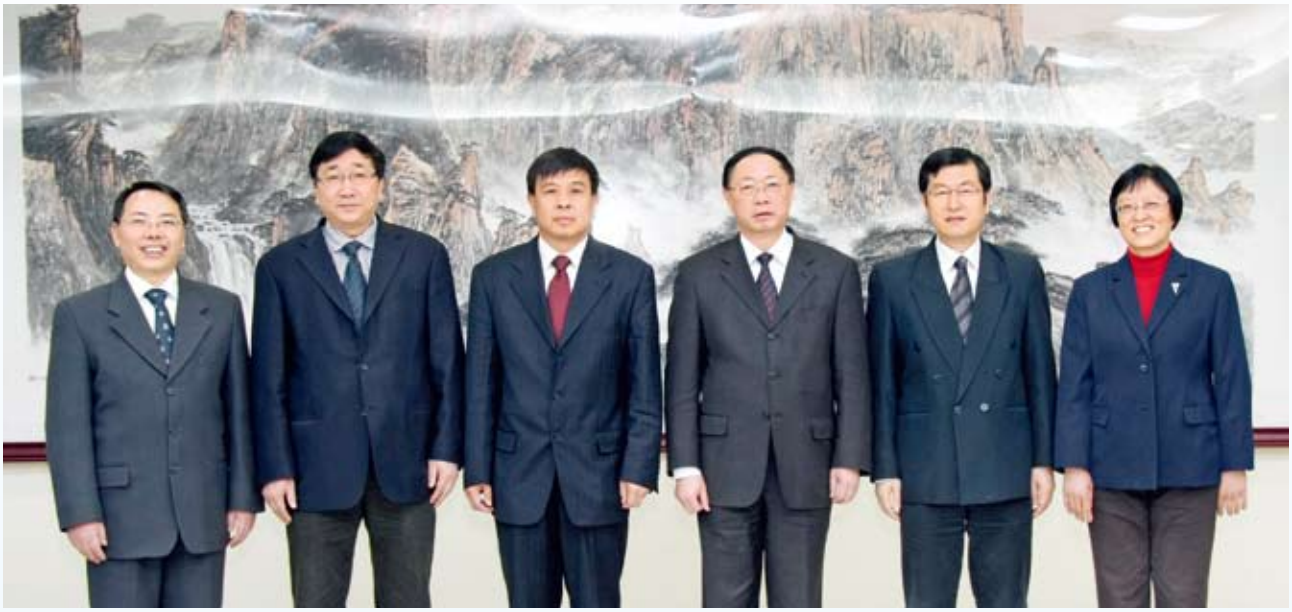
The SinoProbe program (Deep Exploration in China) accomplished all its set tasks: the 10000-meter drilling rig “Crust No.1” started drilling as the ultra-deep scientific drilling project in Well Songke-2; significant results were obtained in the 973 Project “Research of Metallogenesis and Prediction of Potash Salt Resources, and the Study of Formation Mechanisms of Rich Iron Deposits”; the 863 program “Exploration Techniques of Deep Mineral Resources” was initiated. A new-generation airborne integrated geophysical system and an independent power supply dipole geoelectric chemical measurement technique were successfully developed. The precision of microzone and unconventional isotopic analyses attained the most advanced level among laboratories of its type in the world. 2 special programs, 12 sub-programs and 40 projects on investigation and assessment of mineral resources were carried out. 97 research programs are supported by the National Science Foundation of China.

Thirdly, outstanding results were gained in scientific and technological breakthroughs.

Guided by the principle "Focusing on both oil and potash deposits in mineral exploration", notable progress was made in potash salt prospecting. Based on the theory of rejuvenated metallogenesis, integrated mineral prospecting models and combining effective methods in ore prospecting, breakthroughs were achieved in gold prospecting in Hadamengou, Inner Mongolia. Major breakthroughs were made in exploring rare metallic ores in the surroundings of Gyabjeka in Sichuan Province based on the research of ore-controlling factors of pegmatite and related metallogenic laws and ore-searching directions. Investigation of groundwater pollution in the North China Plain and an adaptability study of the carrying capacity were undertaken, which provides an important basis for the integrated development program of the Beijing-Tianjin-Hebei region. The integrated water and soil pollution investigation rapidly located areas polluted by excessive heavy metal of chromium in regional groundwater. The hydrogeological investigation in the karst valleys in Southwest China aided in supplying enough water for more than 30,000 people and over 1000 drought animals. Related work was done for identifying hidden risks of the secondary geological disasters from Ludian earthquake in Yunnan Province. Investigation and evaluation of the geosites in Yanjin County, Yunnan Province were undertaken, and several proposals for global geoparks endorsement were submitted. Training courses were arranged for monitoring and early warning of geo-disasters, prevention and mitigation of natural disasters. Efforts were put in actively promoting scientific and technological cooperation with geological, exploration and mining enterprises, building a platform for enterprises, universities and research institutes to work closely together to promote the transfer of scientific and technological achievements to the market and production.

Fourthly, progress was made in human resources and career recognition.

We initiated "Li Siguang Distinguished Scholar Program" to bring in overseas leading geoscientists, and their innovative researches were supported by basic research funds of the Academy. Prof. Zeng Lingsen received "the National Science Fund for Distinguished Young Scholars"Award and Dr. Li Jianhua was selected as a researcher by the 2014 Hong Kong Scholars Program. Talented professionals were acknowledged and honored: Academician Li Tingdong won the HLHL Foundation Award of Hong Kong, Academician Chen Yuchuan was rewarded a life-honorary member of the International Association of the Genesis of Ore Deposits (IAGOD), Academician Pei Rongfu received the tenth conferral of the Guanghua Engineering Science and Technology Award, Academician Lu Yaoru won the Special Contribution Award for Academicians of Hebei Province, Dr. Shi Jiansheng received the title of National Excellent Scientific and Technological Workers, Dr. Tang Juxing was appraised as a model individual in ethnic unity and progress of the country, Prof. Liu Dunyi for the first time won the Thomson Reuters China Citation Laureates — Highly Cited Researchers Award. 4 experts received the Outstanding Achievement Prize and 9 were awarded the Outstanding Contribution Prize of the third conferral of the Macrolink Group Science and Technology Award. At the same time, graduate and



Wang Xiaolie (3rd R), Vice President of the CGS, Executive Vice President of the CAGS; Zhu Lixin (3rd L), Executive Vice President; Dong Shuwen (2nd R) and Wang Ruijiang (2nd L), Wang Jie (1st R) and Wu Zhenhan (1st L), Vice Presidents of the CAGS

postdoctoral education was further strengthened and new progress was achieved in this regard.

Fifthly, progress was made in scientific and technological infrastructure.

Further advance was made in construction of the experimental base for geological projects of the CAGS. A land of 92 *mu* (9.14 hectares) for this project was approved and the construction area will be 75,500 square meters.

The Project of the Guilin Base of the International Research Center on Karst under the Auspices of the UNESCO was officially awarded by the National Development and Reform Commission. Construction of the Experiment and Research Center for Geophysical and Geochemical Methods and Techniques was reviewed and accepted. The Guangzhou Research Base for Geological Hazards of Karst Collapse was put into operation. The Project of the Xiamen Geological Scientific Research Base received the official reply and approval from the Development and Reform Commission of the Xiamen Municipality. State Key Laboratory of Continental Tectonics and Dynamics passed through the review of the Ministry of Science and Technology. Workshops were held by Beijing SHRIMP Center for experience exchanges of the basic facilities construction. Eight ministerial key laboratories under the Academy were appraised as excellent. Official application was made for the MLR Key Laboratory of Metallogeny and Mineral Resource Assessment to be the State Key Laboratory. International collaboration moved forward.

Improvement was made for standardized administration of geological survey projects. Project budget and capital management were comprehensively strengthened. And construction of the comprehensive science and technology supporting system was smoothly pushed ahead.

The year 2015 is the final year for completing the 12th Five-Year Plan of China, and crucial for comprehensively deepening reform and advancing law-based governance. The year 2015 is also an important year for implementing the strategy of innovation-driven development and advancing scientific and technological reform. We will further carry out “three major tasks”: geological scientific and technological innovation, cultivation of high-ranking personnel and construction of the scientific research and experiment infrastructures; consolidate “three platforms” to improve the supporting services of science and technology: integration of geological surveys and geoscientific research, combination of universities, research institutes and enterprises, and international collaboration and exchange; improve management and service capabilities and actualize “four constructions” to guarantee sound development of all our endeavors: strengthening the ranks of Party officials, improving Party conduct, promoting integrity, and advancing spiritual civilization.

Looking forward, we will further make efforts to innovate geoscientific and technological development so as to make more contributions to the economic development of the society.

Wang Xiaolie
Vice President of the CGS, Executive Vice President of the CAGS

Zhu Lixin
Executive Vice President

Dong Shuwen
Vice President

Wang Ruijiang
Vice President

Wang Jie
Vice President

Wu Zhenhan
Vice President

CONTENTS

Chapter I General Development

1 Actively Promoting Full Combination Integration of Geological Surveys and Scientific Research

The CAGS sent professional and administrative personnel to other research institutes to make investigations, such as the Chinese Academy of Sciences, Chinese Academy of Agricultural Sciences, Chinese Academy of Forestry, China Meteorology Institute and China Institute of Water Resources and Hydropower Research. It held various meetings attended by Academy presidents, institute directors, academicians and professionals, as well as leading middle-aged scientists of the Academy to make trial plans for scientific and technological innovation and implement innovation-driven development strategies. In light of the requirements of the CGS, the Academy actively advanced the cooperation with the local geological survey centers of the six Large Regions. The Academy organized joint meetings among leading officials of the eight Academy-affiliated departments and the local geological survey centers, led investigations and discussions regarding implementing the measures and setting up the cooperation platform, so as to help the institutes and departments of the CAGS involve more field work of geological survey, while helping the local geological centers involve more in science and technology innovation, and further promote the integration of geological survey and geological research.

2 New Steps in the Industry-Academia-Research-Application Integration

Firstly, we need to promote the transfer of scientific and technological achievements to the market and production. The CAGS signed strategic cooperation framework agreements with the Yiyang Group and the Southwest Energy and Mineral Inc. The Academy and the Southwest Energy and Mineral Inc. decided to jointly establish a work station for academicians and postdoctoral fellows. The Academy and China University of Geosciences (Wuhan) decided to introduce and develop large multifunction press machines. The Academy and the Guizhou Bureau of Geological Exploration, Ningxia Bureau of Geological Exploration, Zhejiang Bureau of Geological Exploration and PetroChina reached intent agreement on science and technology cooperation in such fields as transfer of research results into application, information sharing of global mineral resources, multipurpose utilization of tailing resources and making breakthroughs in mineral prospecting. Secondly, we should tackle hard-nut problems in scientific and technological projects. The project “the development of multipurpose utilization

techniques of manganese resources" formulated by the Academy and the Southwest Energy and Mineral Inc. received approval and then experts and researchers went to Southwest Guizhou Province and Lishui area in Zhejiang Province to undertake polymetallic ore prospecting.

On July 7, 2014 the CAGS and the Southwest Energy and Mineral Inc. signed an agreement on joint establishment of a work station for academicians and postdoctoral fellows

3 Smoothly Moving Ahead the Program of Poverty Alleviation

The Academy worked in 2014 to support regions of poverty and bring improvements to backward areas. Yanjin County, Zhaotong City in Yunnan Province was designated as the Academy's working region of the county-level poverty alleviation program. Headed by leading officials of the Academy, investigation groups made trips to this region for many times to find out actual difficulties and demands of the people there, proposed ideas and suggestions about prevention of geological hazards, planning for geoparks and protection of geological relics. The Academy organized a strong team to submit a proposal for acknowledging a provincial-level geopark in Yanjin County. Active investigation of geological hazards and geological landscapes and two geological survey projects were successfully formulated, namely, "Investigation of geological hazards in the Yanjin Region" and "Investigation of geological landscapes of Wumeng Mountain in the Zhaotong Area, Yunnan Province".

Chapter II Human Resources and Finance

1 Human Resources

The personnel in the CAGS consists of permanent employees (serving and retired) and non-permanent employees. Among 2753 permanent positions, 1000 are for non-profit public research. By the end of 2014, the actual number of staff was 3628, including 1932 full-time and 1696 retired. Among those who are full-time, 1402 completed regular university courses, 1114 had master's or higher degrees. There were 1493 technical professionals, including 13 academicians of the Chinese Academy of Science and Chinese Academy of Engineering, 310 research fellows and professor-rank senior engineers, 321 associate research fellows and senior engineers, 559 and 284 researchers with middle and junior professional titles, respectively. Among the professionals, 545 obtained a doctor's degree, 478 had a master's degree, 319 completed regular university courses and 151 received junior college education or below. The CAGS now has a contingent of high-caliber talents with Ph.Ds and masters as the main body possessing strong innovative competitiveness.

Among the staff in employment, 34 were enjoying special government allowances of the State Council, 6 were awarded the title of National Outstanding Young and Middle-aged Specialists with Significant Contributions, 1 researcher was appraised as a leading young scientist in science and technology innovation by the Promotion Program for Innovation Professionals of the MST, 1 was chosen by the National Program for Recruiting 1000 Overseas Top-notch Specialists, and 13 scientists by the National Program for Nurturing and Attracting 100-1000-10000 Talents. 27 scientists were selected as those in a list of the top 100 science and technology innovative talents of the MLR. 11 were selected by the Program for Cultivating Leading Talents in Science and Technology of the MLR and 13 by the Program for Cultivating Outstanding Young Talents in Science and Technology of the MLR. 9 research groups were named Science and Technology Innovation Teams by the MLR. 8 scientists were selected into the Promoting Program for Leading Talents and 29 in the Promoting Program of Talented Young Geologists of the CGS. There were 27 scientists who hold positions at relevant international academic organizations.

2 Annual Expenditures

In 2014, the actual expenditures of the Academy were 2.146 billion Yuan, with an increase of 16.82% over 2013. The Academy appropriated 77.60 million Yuan to purchasing and upgrading experimental instruments and equipment, and rebuilding infrastructure. The Academy purchased 28 sets of large instruments and equipment worth more than 500,000 Yuan each.

Chapter III Research Institutions and Major Scientific and Technological Achievements

The Chinese Academy of Geological Sciences consists of its headquarters and seven institutes. It is a non-profit public geological research organization, administrated by the CGS, and MLR. The Academy is a core component of the national research body for innovation in science and technology. Its major mission is to conduct fundamental research in geological science, and undertake geological surveys to provide theoretical support and technological service for geological survey of the country.

The CAGS Headquarters has the affiliated offices of national and international scientific organizations, including the Office of the GSC, the Office of the National Commission on Stratigraphy, the Secretariat of the Li Siguang Geological Science Foundation, the Secretariat of the IUGS, the Office of Global Geoparks Network, the Secretariat of the National Commission on China International Program in Earth Science, and the World Data Center (WDC) for Geology, China.

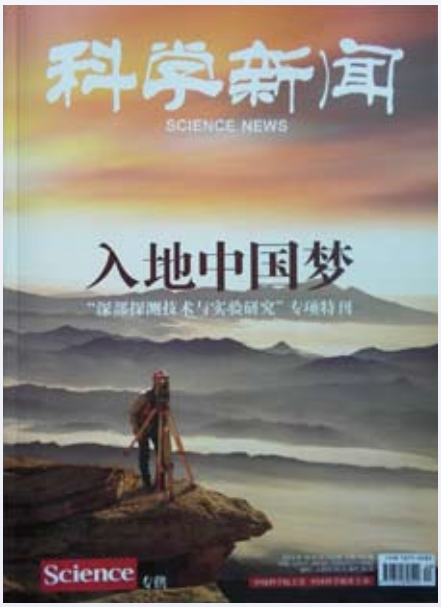
CAGS Headquarters

The CAGS Headquarters comprises the following 12 functional divisions and departments: General Office, Division of Science and Technology, Geological Survey Department, Division of Labs Administration and GeoAnalysis (Office of Key Labs and Field Scientific Observation and Research Base under the MLS), Division of Economic Administration, Division of International Cooperation, Division of Personnel (Division of Production Security), Division of Planning and Finance, Division of Party-People Relation, Division of Supervision and Auditing, Infrastructural Department (Office of Experimental Base for Geological Project) and the Graduate School; 3 administrative centers: Information Center, Administration Center for Retired Staff in Beijing, Logistic Service Center; and 3 research departments: Chinese Geoparks Network, Center for Deep Exploration and Division of Qinghai-Tibet Plateau Research.

Major Research Achievements:

SinoProbe: The first-phase task of the program was completed: 49 subjects were finished and accepted, and the 5th meeting of the leading group was held. Special volumes reporting the research results of

the SinoProbe Program were carried in some noted Chinese journals such as *Acta Petrologica Sinica* and *Acta Geologica Sinica*. A paper summarizing the scientific achievements of SinoProbe entitled "Deep exploration reveals the crustal structure, deep process and metallogenic background in China" was published in *Geoscience Frontiers*. Two special issues introducing this program were published in *Journal of Asian Earth Sciences*. And *Series of Monographs on China's Deep Exploration* consisting of 12 volumes is planned to be published by Science Press. The research program had already published 1030 academic papers, including 240 international SCI-indexed, 212 Chinese SCI-indexed and 68 EI-indexed papers, 8 monographs; received 121 patents, including 49 national invention patents, 34 national patents for utility models, 6 national patents for designs, 2 for standards and 30 with software copyrights. In 2014, the first batch of data acquired were released ahead of schedule.



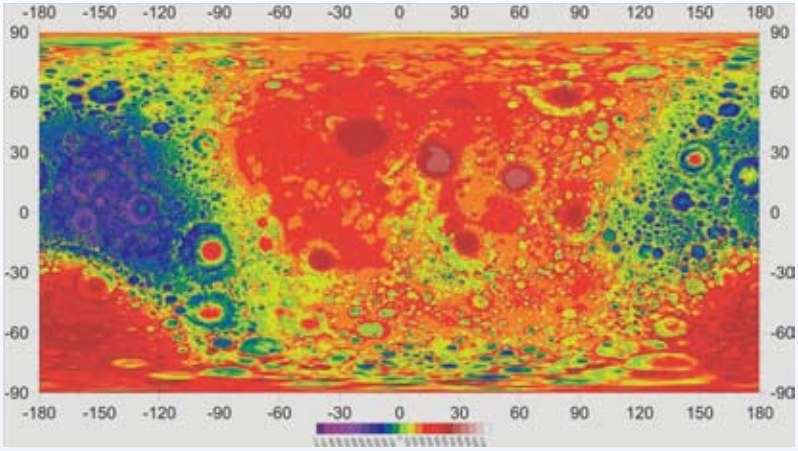
A special issue of Science News on SinoProbe: the Chinese Dream of Probing into the Deep Earth

The model of 10000-m drilling rig "Crust No.1"

New progress made in projects "Research and Application of Remote Sensor Data for Primary Regions on the Moon" and "Construction and Comparative Research on Experimental Field of the Moon and the Mars"

The Achievements of the projects include: compilation of maps showing the ages of three lunar main rock types and the distribution of mare basaltic units, and determination of relative age of the lunar surface by means of impact craters; study of characteristics of the lunar gravity field at an order of 120, and establishment of the lunar Bouguer gravity field through processing and solving the GRAIL data;

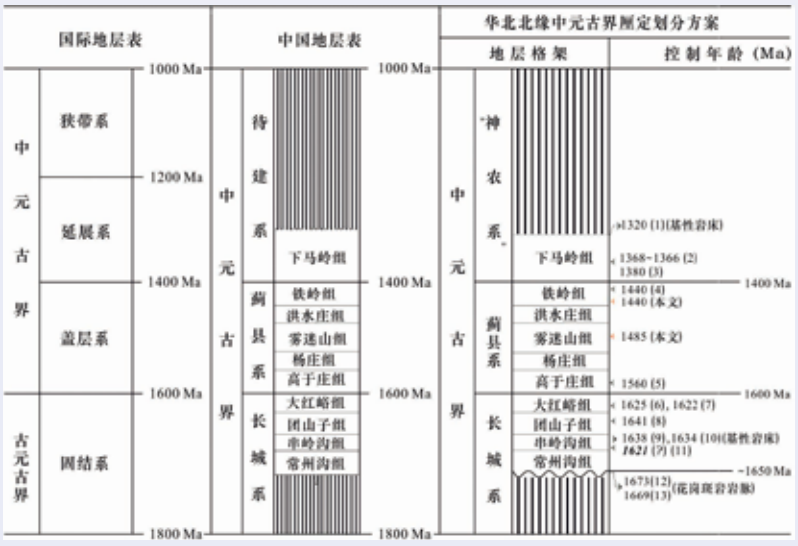
the distribution map of the contents of natural radioactive elements U, Th and K compiled by processing Chang'E-2 gamma spectral data; finding out the evolution process of the salt lake in the Qaidam Basin and the collaborative law for microorganism evolution process obtained based on analog of Martian salt environments and astrobiology research.



Bouguer gravity anomaly of the Moon (grid: 0.250; order: 330 equaling a precision of 16 km) based on LRO topographic data and GRAIL free-air gravity anomaly

Classification and Correlation of Continental Strata and Improvement of Stages of the Marine Strata in China

Significant progress was made in identification of the Substage of the Tournaisian, which has become a potential boundary stratotype section for international competition. Bentonite was found for the first time in the Tieling Formation and Wumishan Formation on the Meso-Neoproterozoic key section in Jixian County, Hebei Province with zircon SHRIMP U-Pb ages of about 1440 Ma [(1439±14) Ma] and about 1485 Ma [(1483±13) Ma and (1487±16) Ma] respectively, indicating two important stratigraphic units in the upper Jixian System, it is also a sedimentary series predominated by carbonate rock on this traditional standard section.



New classification scheme for the Mesoproterozoic strata on the northern margin of North China

Institute of Geology, CAGS

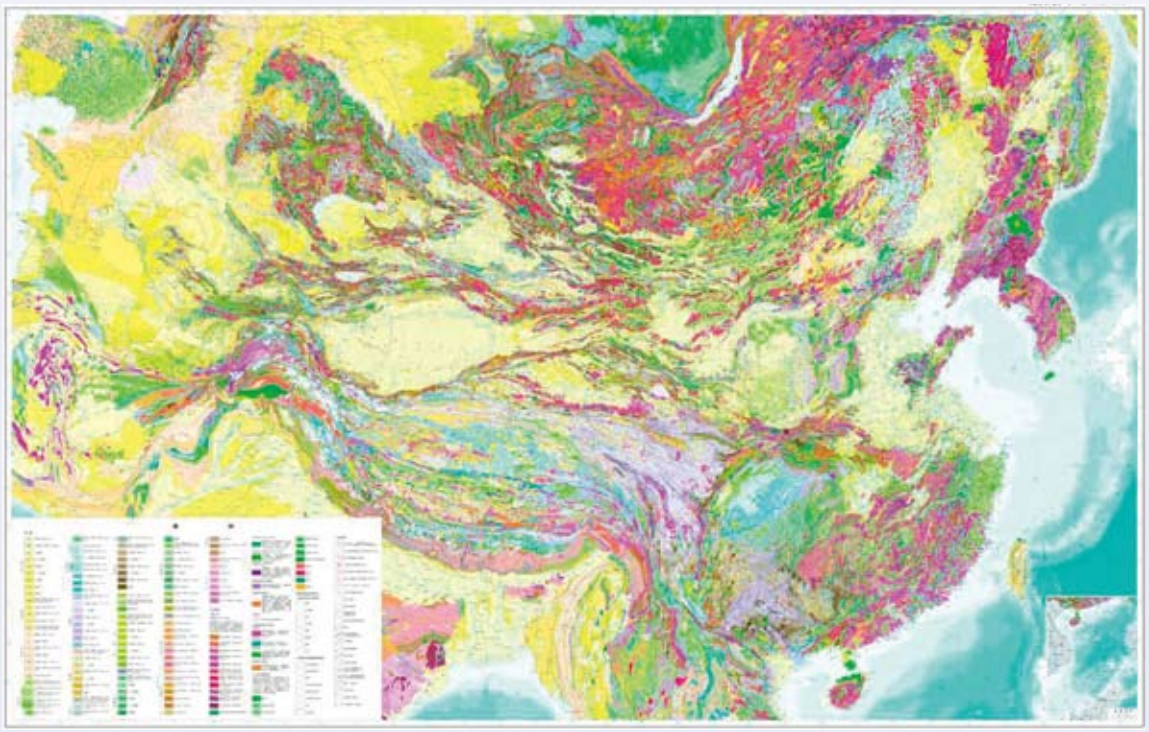
The Institute of Geology has 5 administrative departments, 11 research divisions, 1 State key laboratory, 1 State-level S&T infrastructural platform, 3 ministerial key laboratories. The National Commission of Geological Mapping, Stratigraphic and Paleontological Center of the CGS, academic journal *Petrologica et Mineralogica* and 7 academic organizations are affiliated with this institute.

Major Research Achievements:

A series of Important Geological Maps Completed

The institute completed or published a series of geological maps, including the Digital Geological Map of the Sinus Iridum Quadrangle on the Moon at 1∶2,500,000, Geological Map of China and Adjacent Areas at 1∶3,000,000, Metamorphic Map of China at 1∶5,000,000, Tectonic Map of Ophiolites in the Western Region of China, the Map of Tectonic and Petroliferous Basins of China at 1∶5,000,000, and the Map of Petroleum Province and Main Petroliferous Basins of China.

A new generation of *Regional Geology of China* is under compilation and geological chronicles of 11 provinces or regions were accomplished. The Institute participated in the project of "One Geology China", which won the 2nd prize of the Award for Scientific and Technologic Achievements of Geographic Information.



New edition of the Geological Map of China and Adjacent Areas at 1 ∶ 3,000,000

Notable Progress in the Research of Precambrian and Metamorphism

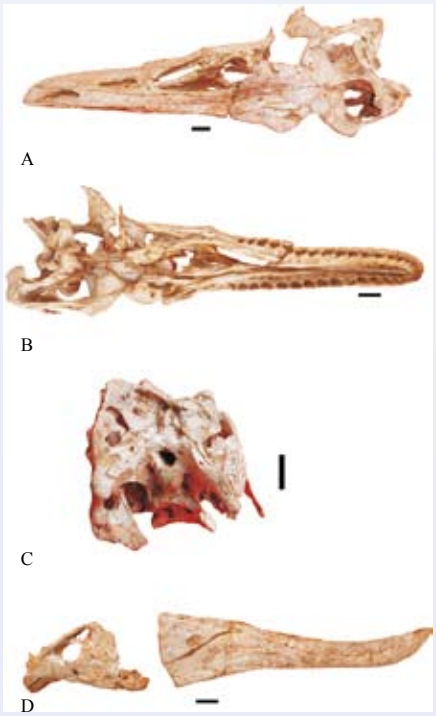
Three ancient terranes (> 2.6 Ga) were identified for the first time in the North China craton; crustal growth of the Jiaobei terrane, important geological events and important magmatic events were newly defined; a bidirectional subduction exhumation model of the North China craton was proposed; study of Paleoproterozoic Columina assemblage event and Mesoproterozoic rifting event, which is of significance to the correlation study of the outward accretion-rifting history of the Columbia supercontinental margin in the early-middle Proterozoic and reconstruction of the Columbia supercontinent.

A Series of Results Obtained in the Research of Important Orogenic Belts and Their Structure

This research reconstructed the geodynamic environments of the Chinese continent in different geological periods of the Phanerozoic; proposed a 3-D extrusion model of the Great Himalayan thermal collisional orogen for the first time; proposed two possible models for the India/Asia subduction collision: the space-differential subduction-collision model and the time-differential subduction-collision model; located the position of South China in the Rodinia supercontinent during the Neoproterozoic and inferred that there existed a "concealed" Grenville orogen on the southern margin of the Cathaysian system; built an evolution model for the Paleozoic structure of the northern margin of North China; found evidence that the Alxia block was a landmass lying on the northern margin of East Gondwana in the early Paleozoic period, which was eventually amalgamated with the North China block in the Late Devonian.

Many New Findings Discovered in Stratigraphic and Paleontologic Research

The major results include establishment of the most complete $\delta^{13}C$ (‰, VPDB) profiles and biostratigraphic succession of acritarchs of the Ediacaran system at one section, and the acritarch biostrata; complete discoidal carbonaceous *Kullingia*-like macrofossil found in Tongren, Guizhou Province; the Permian-Tertiary boundary section identified in Wenbudangsang of Gê'gya County based on the study of conodont; discovery of the Ruyang Gigantic Sauropod dinosaurian fauna in Henan Province, which has filled the gap in the study of dinosaur fauna of the same geological time in China; discovery of fossil coenosis of dinosaur eggs in Xichuan County, Henan Province, which is of great importance to the study genital and life behaviors of dinosaurs; a new clade of Tyrannosaurids, Qianzhousaurus Sinensis was found in Ganzhou, Jiangxi Province; a new species of Neomithes – *Poff Gansus* discovered in the Jehol Biota. The discovery also includes a fossil record of most ancient prehistoric reptile's postpartum parental care behavior.



Skull and mandible of *Qianzhousaurus*

Significant Progress in Geophysical Prospecting and Deep Probing

The study revealed the deep process of structural transform of the marginal mountains in the Qinghai-Tibet Plateau and the surrounding cratonic lithosphere (crust and mantle), and acquired evidence from behavior of lithospheric mantle that can prove the North China craton was wedging into the northeastern margin of the Qinghai-Tibet Plateau; identified the Moho in extremely thick crust inside the Qinghai-Tibet Plateau, placing a new constraint on the crustal structure of the Qiangtang terrane. The research on the Longmenshan fault showed that the large strike-slip fault on the eastern margin of the Qinghai-Tibet Plateau controls thrusting of the crust and discovered the deep process of the closure of the Paleoasian Ocean along the Solonker suture, continent-continent collision and post-collisional crustal accretion. The study also found seismic evidence for the thin crust (60~70 km) on the southeastern margin of the South China continent.

New Advances in Application of Isotopic Analytic Techniques and Study of Standard Materials

Important progress was achieved on the application of (U-Th)/He cryogenic thermochronological methodology in petroliferous basin research; the standard materials for Ti isotope from basalt and various Nd isotopes were developed, which have passed the national appraisal for first-class standard materials. Newly developed Fe- and Mg-isotopic techniques were applied for the first time to direct tracing for mineralized elements themselves and the major elements of ore-bearing beds.

Breakthroughs made in Mineral Prospecting Supported by Research of Sedimentary Basins, Resources and Energy

A 3-D seismic survey of hydrate was conducted for the first time in China and the result of drilling is in agreement with the predicted result. Systematic research was done by combining geological investigation, logging and geophysical research, which provided a solid basis for geophysical prediction of the solid potash deposit in the Menyejing area of Yunnan Province and the liquid brine in the Qaidam Basin of Qinghai Province. A preservation model within the lower oil shale layer (K_2n_1) and a productivity model within the upper oil shale layer (K_2n_2) are established in the Songliao Basin. A statistical analogue method was applied to the evaluation of potential oil shale resources in large-sized depressions and basins. Geological survey and mapping of Mesozoic continental basins were carried out in Northwest Hebei Province.

Great Influence of Petrological and Mineralogical Research in Academic Circles

It is a significant milestone that diamonds were found to occur in situ within chromite grains from Luobusa and Polar Ural chromitites. This discovery was released and has received favorable comments from geologists. Deep mantle minerals such as diamond, moissanite and coesite were found in 6 ophiolite belts in the world, which was considered to be a common phenomenon of ophiolitic oceanic mantle peridotite and hence some classic facts should be reexamined, such as the composition of oceanic

mantle and the movement of mantle. New type ultrahigh-pressure minerals were found in diamond and these minerals were proven to be generated from the lower mantle according to petrological experiment. All the above findings have put forward new problems and challenges to the traditional theories and therefore we need to have a new review regarding the theory that ophiolite and chromite are generated in shallow strata.

Institute of Mineral Resources, CAGS

The Institute of Mineral Resources has 13 research divisions (centers), 6 management and supporting divisions and 1 technical Transformation Center, 2 ministerial key laboratories. the Commission on Deposit Geology of the GSC and Commission on Mineralogy of the Chinese Society of Mineralogy, Petrology and Geochemistry are affiliated with this institute. Academic journal *Mineral Deposits* is also sponsored by this institute.

Major Research Achievements:

Advance in the Study of Metallogenesis and Prospecting of Granitic Pegmatite Deposits in Gyabjeka in Western Sichuan

The study established an ore-hunting model with H_2O-rich two-mica granite being the endogenesis, and with highly denuded, relatively closed and limited open metamorphic domes being the extrogenesis. And it proposed the ore indicator for the Gyabjeka type deposits. Based on this indicator, prospects of mineral exploration in the western Sichuan-Western Kunlun were analyzed, concluding that deposits in Gyabjeka, Keryin and Dahongliutan have the same metallogenic model and ore-hunting indicator with only denudation degree varied.

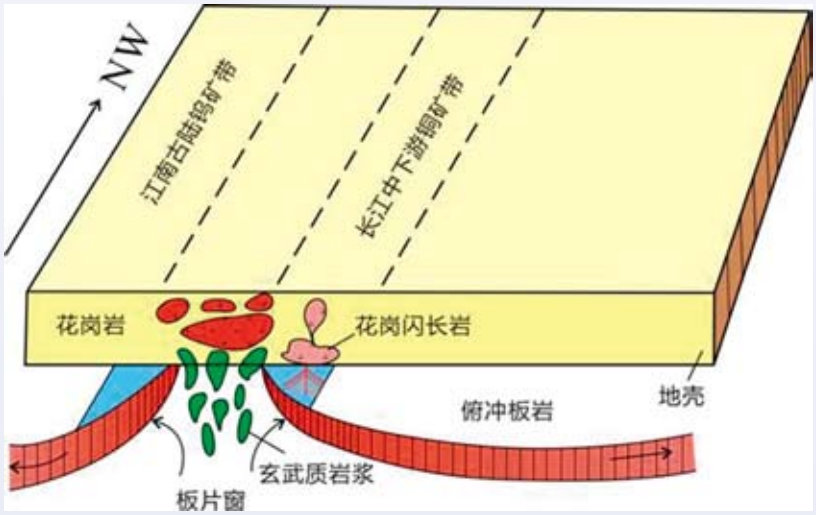
Gyabjeka Lake

Continental Rifts Relating to Formation of Potash Deposits and Breakthroughs in Potash Prospecting in the Jiangling Area

This study proposed the metallogeny of potash deposits in small rift basins. Seismic prospecting and data exploration were carried out in the Jiangling depression including four deep boreholes, yielding a prediction of 200 million tons of potash salt controlled by engineering as well as abundant associated resources such as boron, lithium, rubidium, cesium, bromine and iodine, as well as shows of solid potash salt.

Advance in the Study of Metallogenic Regularities and Backgrounds of Mineral Deposits in South China

The study revealed that mineral deposits formed at 135~80 Ma were developed in extensional basins on the continental margin; proposed that the Cu-polymetallic belt in Qinhang and the middle-lower valleys of the Yangtze River are closely related to the tearing of the Izanagi slab during subduction along the conjunction of paleotectonic units; and concluded that the copper belt in the middle-lower valleys of the Yangtze River and the tungsten belt in the Jiangnan old land, which are parallel to each other, should be a product of the same tectonic event.



A dynamic metallogenic model of Mesozoic metallic ore deposits in the middle-lower valleys of the Yangtze River and adjacent regions

Study of Important Mineral Resources in China and Related Regional Metallogenic Regularities

This study put forward technical requirements for the study of important ore resources and related regional metallogenic regularities, which effectively guided the study in provincial-level ore-prospecting units, which for the first time covered all I-, II-, III- and IV-class ore-forming belts and districts. A classification scheme of prediction types of mineral resources was proposed for 23 ore types, and 388 prediction types were defined. A study of 17 single ore types was conducted and their ore-forming

belts were ascertained. Systematic study was carried out on metallogenic regularities of 17 ore-forming provinces, which improved the metallogenic models and hierarchical systems of all ore-forming provinces. The study analyzed the potential of ore prospecting, so as to provide a scientific basis for the plan of mineral prediction and prospecting; published *Lists of Ore-forming Models on the Typical Mineral Deposits, Atlas of Field Survey on the Typical Mineral Deposits* and a Collection of Isotopic Ages of Metallogenesis and Diagenesis, consisting of 11886 data, so as to provide a scientific basis for the evaluation of mineral prediction and prospecting. Significant advances were made in the study of regional metallogenic regularities, such as the "five-stories+basement" model, Mesozoic magmatic ore-forming process in South China, symmetry of magmatic ore-forming processes on the northern and southern sides of the North China Plate and Junggar Plate, and large-region distribution of nickle deposits. New ideas about some topics were proposed, such as multiperiodic ore-forming process of gold, antimony, mercury deposits in the low-temperature metallogenic domain in Guizhou and Hunan provinces; the spatial relationship between large arcuate, ϵ-type, vortex and ν-type deformation structures and the distribution of ore deposits in China. These new ideas are of great importance in further metallogeny studying and the above research results provided also an effective guidance to evaluation of prospecting of important deposits.

Institute of Geomechanics, CAGS

The Institute of Geomechanics has 8 research divisions (centers), 5 functional divisions and 2 public-service departments; 2 ministerial key laboratories, 2 field scientific observation and research bases, 1 CGS key laboratory, 1 CGS administrative center and 2 CAGS key laboratories.

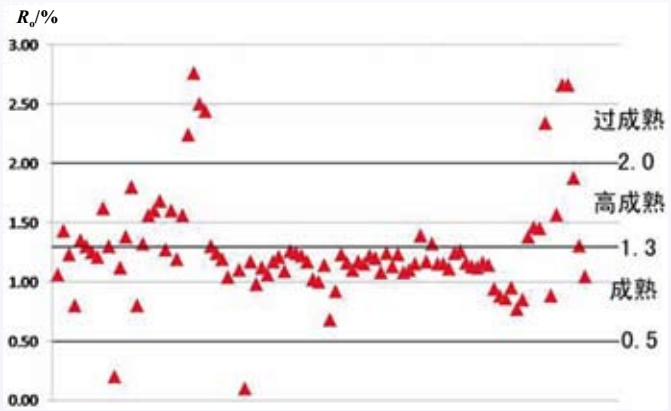
Major Research Achievements:

Investigation of Petroliferous Resources in the Qaidam Basin Opened a New Frontier of Oil-Gas Prospecting in Carboniferous Strata

Second prize of the National Award for Science and Technology Progress

The study identified the distribution and residual thickness of the Carboniferous strata in the Qaidam Basin and revealed that Carboniferous strata are developed extensively under the Meso-Cenozoic Erathem and made classification and correlation for the Carboniferous of the Qaidam Basin. Lithofacies-paleogeographic maps of different stages from the Upper Devonian to the Carboniferous were completed during the research project. The study proved that hydrocarbon source rock is well developed in the Carboniferous in the Qaidam Basin and has favorable oil-generating condition with

many oil and gas shows. The oil-to-source correlation shows that the oil and gas sources are generated from Carboniferous hydrocarbon source rock. The study indicates that the Carboniferous tectonic deformation took place mainly in the terminal Neogene in the Qaidam, and such tectonic deformation is favorable to oil and gas accumulation.



Maturity of organic matter from the Carboniferous hydrocarbon source rock in the Qaidam Basin

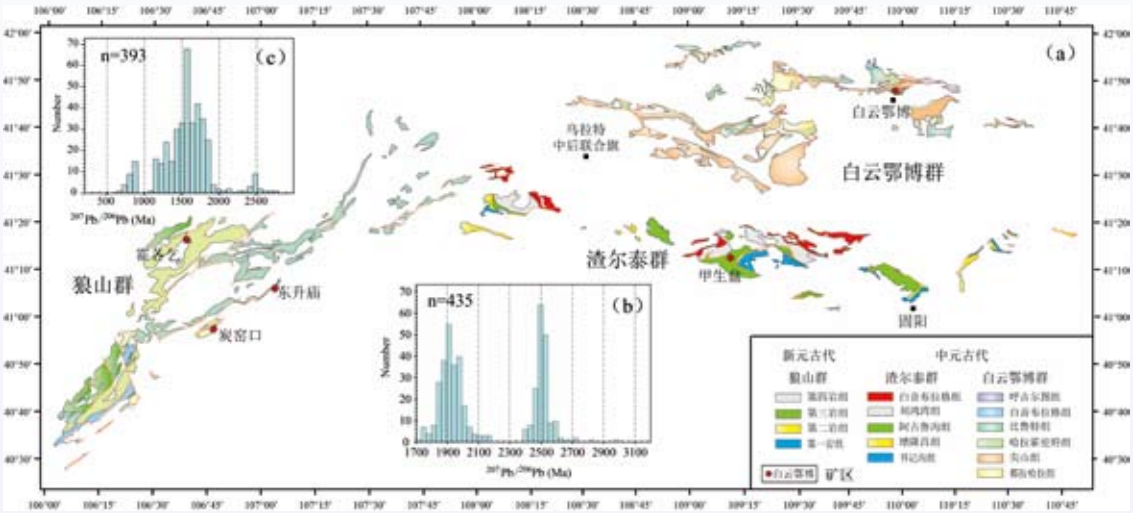
New Results in the Study of Tectonic Evolution Process and Dynamics of the Cretaceous in the South China Continent

This project studied the tectonic evolution process of the Cretaceous in South China based on analysis of the basin sediments, tectonic deformation and magmatic evolution. For the first time it proposed a 3-stage, extension-compression-alternating evolution model. In the Early-Middle Cretaceous (136~80 Ma), when South China had a back-arc spreading background, regional sedimentation-magmatism-deformation was related to the subduction of the Paleo-Pacific plate. The extension-compression event reflected the dynamics featuring complicated subduction of lithospheric slabs during a back-arc spreading process. In the Late Cretaceous (80~65 Ma), a significant change took place in the dynamics of the surrounding plates and slab subduction of the Neo-Tethyan tectonic domain controlled a new round of crust extension and rifting, and sedimentary evolution.

New Progress in the Project of Characteristics of the Multiperiodic Rifting Event in the Neoproterozoic and Related Metallogenic Preference

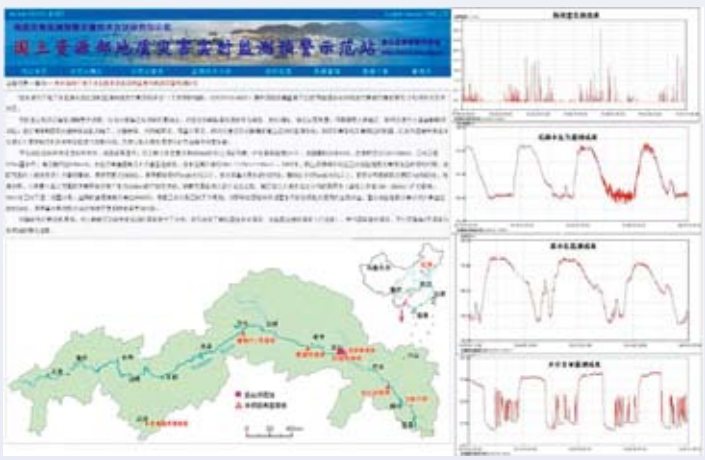
The study gave the zircon U-Pb age of the metamorphic volcanic rock of the Zhaertai Group [(804.1 ± 3.5) Ma], which, in combination with other research results, indicates that the Zhaertai Group in the Langshan area is primarily Neoproterozoic in age (800~1100 Ma), while the Zhaertai Group in the Zhaertaishan area is Mesoproterozoic. It then suggested that the denomination of "Langshan Group" be reused, which particularly stands for a suite of Neoproterozoic strata in the Langshan area. The above result not only shows that Neoproterozoic strata are no longer absent in the North China craton, but also argues that the previously identified Mesoproterozoic Langshan-Zhaertaishan-Bayan Obo metallogenic belt should be separated into two metallogenic belts: Mesoproterozoic one and Neoproterozoic, and that

the large submarine volcanic exhalation deposit developed in the Langshan Group should be younger than the Neoproterozoic.



(a) Stratigraphy of the Meso-Neoproterozoic in the Langshan, Zhaertaishan and Bayan Obo areas; (b) isotopic dating of the Zhaertai Group. (c) isotopic dating of the Langshan Group

Supporting Role of Geological Survey to Enhance the Ability of Preventing and Mitigating Natural Disasters--Project "The Formation Model of Geohazards in the Complex Mountainous Regions in Western China"



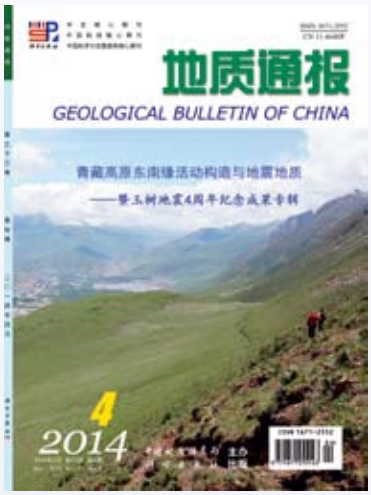
Systematic real-time monitoring of landslides

In this research project, study was conducted on scientific problems related formation model, monitoring and forewarning of geologic hazards in complex mountainous regions in western China and on the key techniques in emergency treatment and how to improve prevention measures. The project identified some demonstrating areas for real-time monitoring and early warning of geological hazards in complex mountainous areas, so as to raise the technical and theoretical level in emergency and rapid consolidating against geological hazards and risk evaluation, thus providing a theoretical basis and technical support to prevention and mitigation of geological hazards in complex mountains in the west part of China.

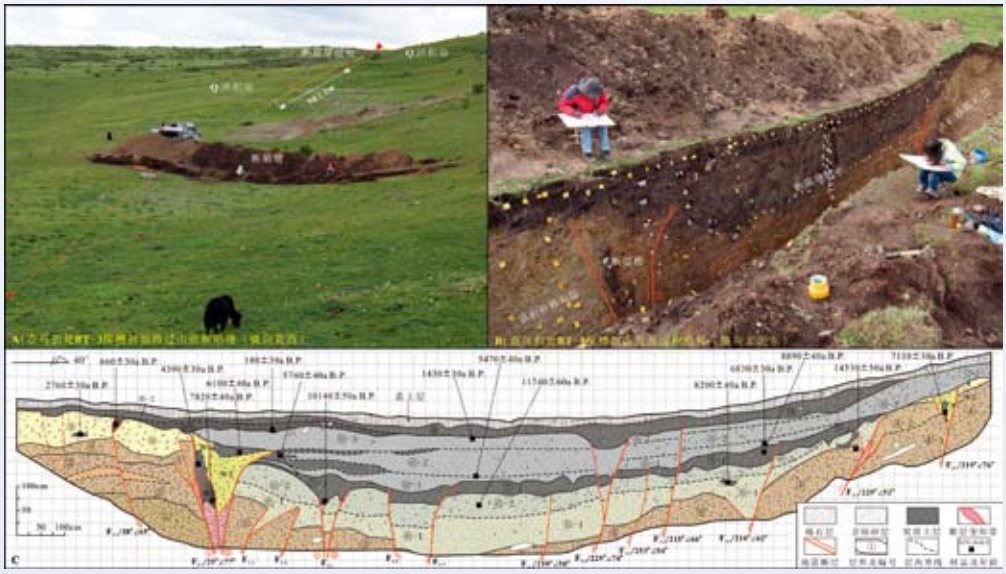
Identification of Important Active Faults and Integrated Research of the Active Structural System on the Southeastern Margin of the Qinghai-Tibet Plateau

Intensive investigation was carried out in identifying the distribution, components and activity of the major active faults, and historical and ancient seismic events in the study area, a high-resolution image showing the distribution of surface fracture of this area was obtained.

The study shows that the Yushu mobile fault belt became the terminal structure of the Yushu-Xianshuihe-Xiaojiang fault, belonging to a typical Z-type sinistral tenso-shear deformation belt with a sinistral slipping velocity up to 4.0~5.4 mm/a during the late Quaternary, which is a fault featuring the most active seismic activity and has affected the extrusion and rotation degree of most blocks of this area. The research of ancient earthquakes revealed that the main strike-slip fault belt of the Yushu fault has very varied recurrence intervals of large earthquakes during the Holocene, with an average interval longer than 1000 years and the longest being about 3000 years. Based on the newly revealed seismic regularity of ancient earthquakes, it is considered that there exist at least 6 seismic gaps with various risks in the Yushu fault belt and the estimated magnitude of potential large earthquakes ranges from 6.6~7.3.



The cover of *Geological Bulletin of China* (a special issue for the Yushu earthquake)



A section of the western wall of the exploratory trench in the southeastern segment of the Yushu fault zone

Institute of Hydrogeology and Environmental Geology, CAGS

The Institute of Hydrology and Environmental Geology has 8 administrative divisions, 16 research divisions and 3 logistics support departments. Affiliated with the institute are the China National Chapter of the International Association of Hydrogeologists, Commission on Hydrogeology, Commission on Geothermal Resources and Commission on Agricultural Geology, GSC, and the Mineral Water Product Quality Supervision and Inspection Office of Hebei Province.

Research Fellows Shi Jiansheng and Wang Guiling were invited as national chief experts for science popularization. The pump nozzle sampler for water with organic pollution, which received the national patent for utility models, was successfully put into batch production.

Major Research Achievements:

Establishment of the Modern All-process Analytical and Technical System for Groundwater Pollution Investigation in China

The project overcame technical difficulties in collecting trace components and successfully developed a sample-collector series, developed high-efficiency applicable in-situ investigation techniques and off-line extraction techniques, and rapidly and correctly discovered the groundwater pollution situation in key areas of the country. Land utilization and distribution of polluting sources were investigated by means of high-resolution remote-sensing data. The project set up an experimental platform for organic matter analysis with the remote network for quality monitoring and control for 33 laboratories throughout China.

A Significant Breakthrough Made in Deep Hydrogeological Survey and Comprehensive Assessment of Large Basins and Typical Southeast Coastal Areas in China

Notable breakthroughs were made in the investigation and assessment of high-temperature geothermal resources and hot dry rock prospecting, hydrothermal resources, and superficial geotemperature energy resources. The project found high-temperature geothermal anomalies in many areas. A geothermal drilling in Gudui geothermal area of Tibet shows a temperature up to 195°C at a depth of 230 m, which is the drill hole that has the highest temperature at this depth compared with all other drill holes in

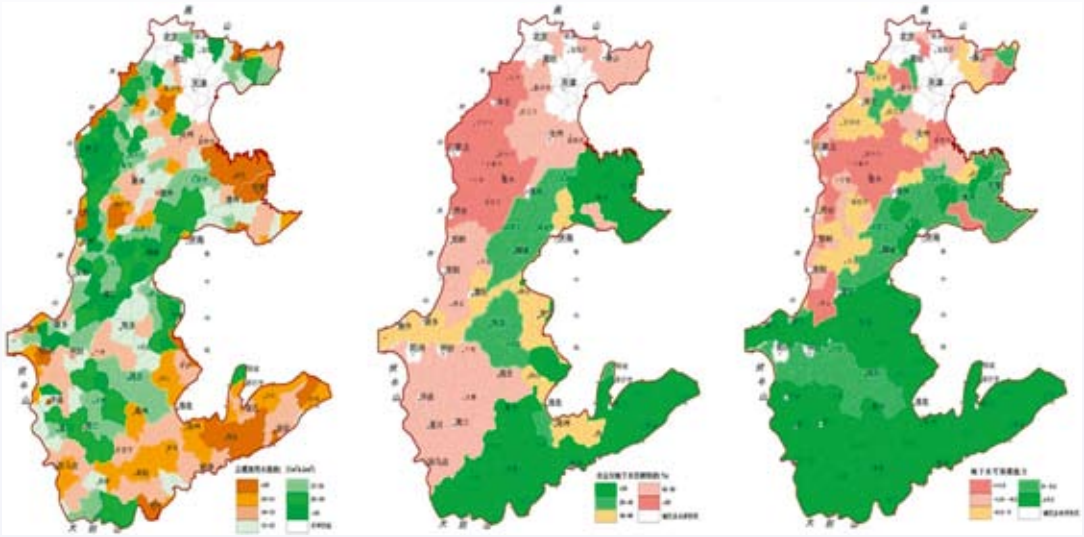
A thermal-pit geyser

Drilling of hot dry rock in Zhacanggou of Guide County

China. In this project, a study of scientific development and utilization of hot dry rock was conducted for the first time in China. Advance was made in site selection for hot dry rock in the southeast coastal areas of China and geophysical investigation of hot dry rock resources in this area was completed.

Strategic Study of Groundwater Resources and Related Environmental Problems of China

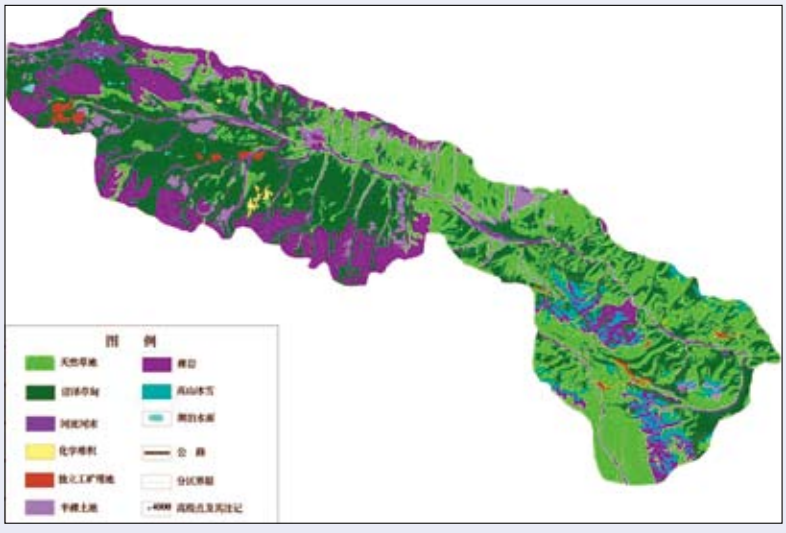
This project for the first time found out the relationship between the groundwater overexploitation and the irrigation agriculture; the influence of water consumption of autumn crops, vegetables and water-intensive fruit trees on ground water overexploitation and relevant regulation threshold; and the mechanism of optimized allocation of groundwater resources. Comprehensive optimal water-conserving irrigation program and countermeasures were worked out, which yielded notable social and economic feedback. Special publications include *Guideline and Technical Requirements of National Main Aquifers Maps and History of China's Hydrogeology, Engineering Geology and Environmental Geology*, which serves as an important guidance to the development of hydrological, engineering and environmental geology work in China.



Water utilization for agriculture irrigation, dependency level on groundwater and ability to ensure groundwater supply in the Huanghai-Huaihai River Region, one of the national grain producing bases of China

Hydrological and Environmental Geological Surveys in Important Energy Resources Regions in China

A series of surveys were carried out including “hydrogeological survey in important energy bases in Qinghai Province”, “hydrogeological survey in the Shendong coal base and reconnaissance of old mined-out areas” and “hydrogeological and environmental geological surveys in energy bases in East Shanxi Province”. Drilling of a group of water exploration and exploitation wells were completed with a total water yield of about 14736 m^3/d, so as to effectively mitigate the water shortage in mining districts.



Land coverage map of the large coal base in the Qilianshan area

1 : 50,000 Hydrogeological Survey in the Badain Jaran Desert

This project accomplished field investigation in lake areas of the Badain Jaran Desert, which was conducted for the first time in China. It was the first to finish a 350 m-deep hydrogeological drilling in a desert area, which discovered the structure of Quaternary sedimentary basement and aquifers, acquired hydrogeological data of this desert area, so as to provide a good basis for the research of hydrogeological conditions in desert areas.

Hydrogeological drilling in a desert area

Strategic Research of the Development and Utilization of Geothermal Resources in China

This is a key consultant project of the Chinese Academy of Engineering. It analyzed and summarized the development and utilization situation of various geothermal resources of China, located prospective high-temperature and medium-low-temperature geothermal areas (fields) and presented suggestions for the scale and future layout of geothermal power generation in China. This study revealed the distribution of hot rock resources and outlined some prospective areas, put forward the objective and direction for intensive development and utilization of geothermal resources in China, drafted a route chart for the research of key technology in geothermal development and utilization.

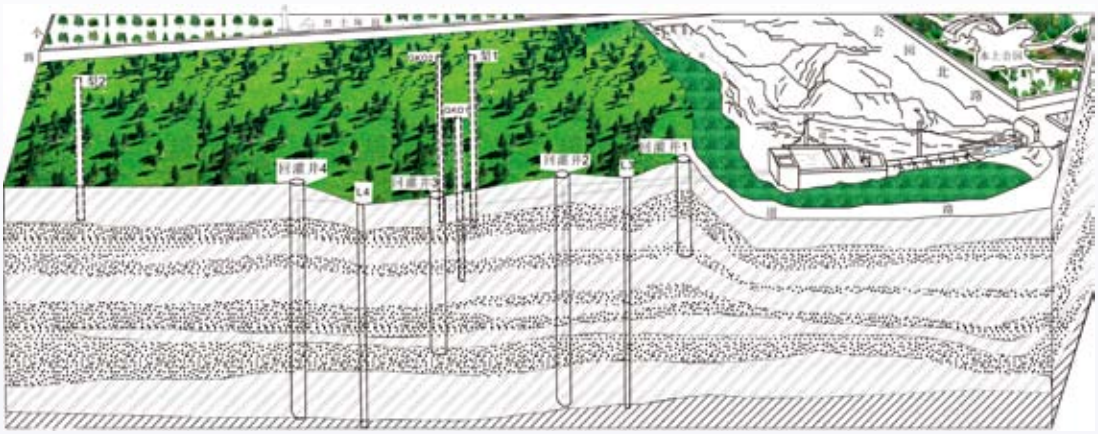
Study of Mechanism for the Influence of Structural Variation of Aquifers Driven by Group Coal Mining on Regional Water Circulation

This study analyzed and summarized the development of mining-induced fractures and structural variation regularity of aquifers, clarified the characteristics of fracture development in goafs and permeability regularity, set up a digital model for the structural variation of aquifer space in typical mining districts and created a concept of “elliptic parabolic concave” for the jump curve surface of permeability in goafs.

Physical simulation of structural damage of aquifers

Key Technology and Engineering Demonstration of Groundwater Recharge in Typical Areas in the North China Plain

The project completed a 3-D stratigraphic structure map of the trial field and established a series of hydrogeological parameters of prospecting in recharge areas by means of software GMS. Other results of this project include a 3-D model of groundwater recharge; high-precision simulation technique and information technology of optimal control and management of groundwater; a 3-D groundwater model for the alluvium and pluvial fan of the Hutuo River; a coupled model developed by using the nesting technique, which combines a regional model and a demonstration-area model; and a model for solute migration of the major contaminating components during groundwater recharge in demonstration areas.



3-D diagram of a trial field for groundwater recharge

Risk Evaluation of Geological Environment and Study of Key Technology for Prevention and Control of Geohazards in Urban Development

Taking landslides and debris flows in Lanzhou and Tianshui, Gansu Province as the objective, this project established a technique-method system of risk evaluation for landslides and debris flows; taking Zhengzhou City as a case study, studied causes and mechanisms of surface subsidence in cities in the middle and lower reaches of the Yellow River, so as to provide a basis for the study of risk evaluation and related techniques of land subsidence in such areas; taking cities of Shijiazhuang, Beijing and Luoyang as the study objective, studied migration regularity of pollutants in vadose zones and pollution-controlling ability of vadose zones; improved techniques and methods for the evaluation of pollution-controlling ability of groundwater, provided a basis for the risk evaluation of groundwater pollution.

Institute of Geophysical and Geochemical Exploration, CAGS

The Institute of Geophysical and Geochemical Exploration (IGGE), CAGS undertook 123 science projects in 2014 with the total annual fund of 179.72 million yuan, including 16 national science projects, 10 special MLR public-welfare projects, 45 geological survey projects, and 43 basic scientific research projects. The institute obtained 16 patents and copyrights, issued 129 scientific papers (including 22 SCI and EI papers) and published 1 monograph, and received one first prize and two second prizes of the MLR Award for Science and Technology.

As of the end of 2014, the institute had 378 employees, 271 employees of which are professional technicians, including 1 academician of Chinese Academy of Sciences, 73 professor-level and 57 associate professor-level senior geophysicists and geochemists; 38 employees with doctor's degree, and 127 employees with master's degree. Now the institute possesses 6 functional departments and offices, 5 service departments, 11 research divisions, and 1 enterprise. The institute has the UNESCO Global Scale

Geochemical International Research Center (under construction), National Modern Geology Exploration Engineering Technology Research Center, 1 ministry-level geochemical exploration supervision and inspection center, 2 ministry-level key open laboratories, 1 geologic survey service center, and 1 academy-level key laboratory. The Commission on Exploration Geochemistry, Commission on Geophysical Prospecting and Commission on Non-Destructive Inspection of Pile Foundation of the GSC, the Geological Exploration Technical Subcommittee of the China National Technical Committee for Standardization of Land and Resources are also affiliated to the IGGE, and the IGGE is entitled to grant Master's degree of Geodetection and Information Technology.

Major Research Achievements:

Practicality and Demonstration of Time-domain Fixed-wing Airborne Electromagnetic Measuring System (National High-tech R&D Program (863 Program) and Geology and Mineral Survey and Evaluation)

With the help of the HAFEI Aircraft Design Institute, HAFEI Voyage Repair Corporation, Feilong General Aviation Co., Ltd as well as the trial flight crew, the project overcame ten trial flight technological problems, made 13 flights, achieved 32 trial flight adjustments within 3 stages, accomplished research tasks for time-domain special aircraft including maiden flight, trial flight adjustment and one sortie of full-state debugging and trial-flight. Moreover, the project gathered 2.3 GB of raw data, recorded experimental data of ground noise machine for 3000m upper air system with the length of suspension at 100 m and 130 m as well as data of aircraft primary and secondary field. The peak of emission current amounted to 722A, whereas that of magnetic moment reached 61.23×10^4 Am^2. Overall, the full-state debugging and trial-flight achieved great success.

Successful maiden flight of time-domain special aircraft B-3855

Engineering Development of Large-depth Three-dimensional Electromagnetic Survey Technique (National Development Project for Scientific Instruments)

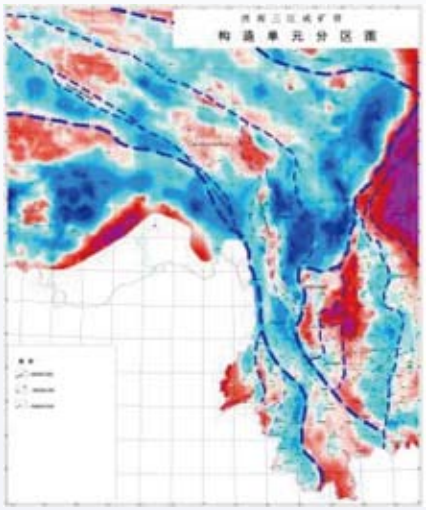
The project successfully developed the model machine of three-dimensional electromagnetic survey system. Field trial of the three-dimensional multi-functional electromagnetic system model machine, transient electromagnetic system model machine and inductive sensor demonstrated that the measurement index of the instruments were accurate and that performances were reliable. The receiver operated steadily and the maximum voltage for power supply of the transmitter reached up to 1500V. Meanwhile, through application of the developed model machine, various methods and devices were used in the mining area for observational experiments and utilization. Comparative analysis of the obtained metrical information and existing exploitation achievement in the mining area reflected that the three-dimensional surveying results could reveal the 3D spatial distribution of the mineral deposit, thereby first time realizing the possibility of 3D geophysical survey.

3D multi-functional electromagnetic receiver and transmitter

Three-component transient electromagnetic receiver and transmitter

Achievement Integration and Method and Technology Research of Regional Geophysical Survey as well as Regional Geochemical Survey in Metallogenic Belt (Geological and Mineral Survey and Evaluation Project).

The project developed methods and techniques for geophysical prospecting, completed 132,000 square kilometers of regional geophysical survey and more than 5,000 square kilometers of 1:50,000 geophysical survey, which made the progress of 1:250,000 regional gravity survey in national land area increased from 49.6% to 51.0%. The project also compiled maps and drawing for basic geophysical survey in key metallogenic regions, finished comprehensive regional geophysical research for relevant key metallogenic areas. The Sanjiang region in the southwest, for instance, was comprehensively studied and its tectonic units as well as fault structure were categorized by using the latest regional gravity data. The project also developed methods and techniques for regional geochemical prospecting, totaled 90.15% of field geochemical prospecting in China.



Zoning plan of the tectonic unit of the metallogenic belt in the Sanjiang region in southwest China

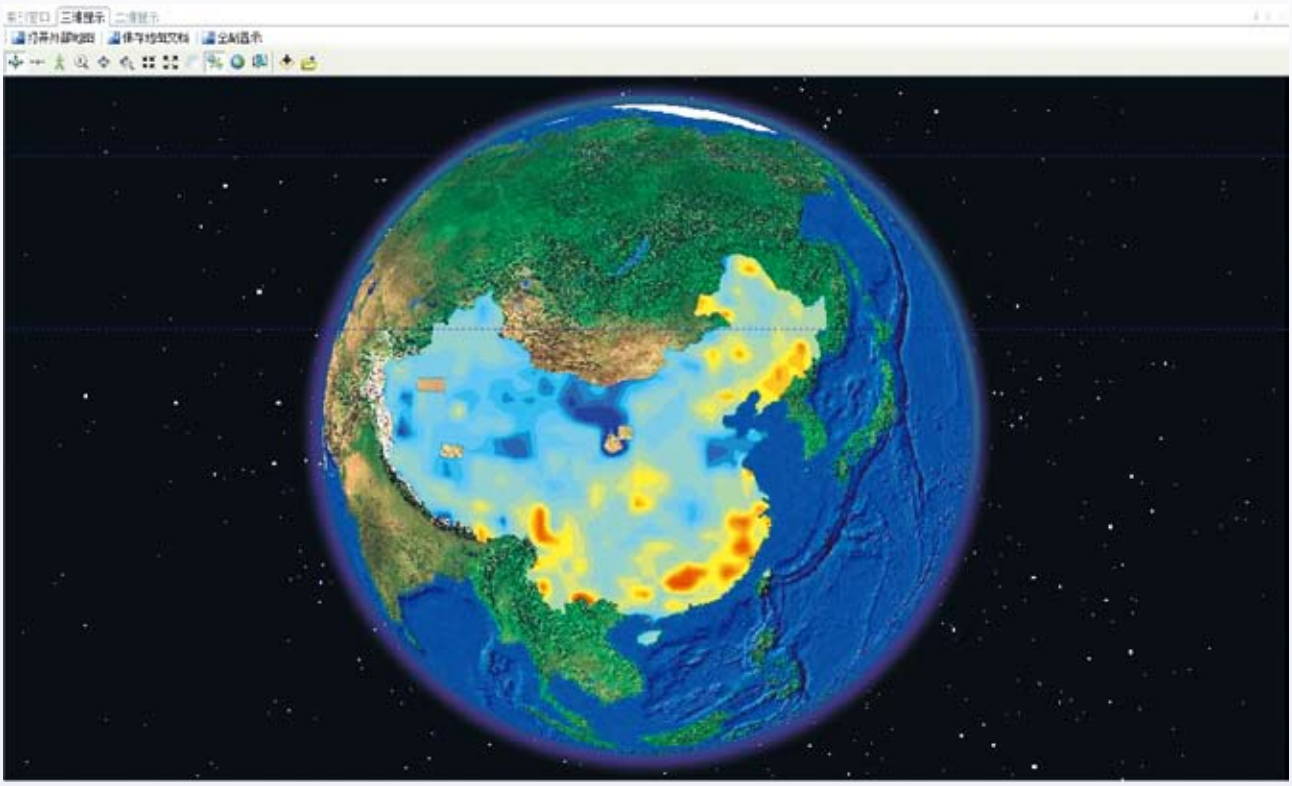
Establishment of Geochemical Baseline of 81 Parameters (76 elements included) in the Mainland of China

The development of a precise crustal element analysis system including 76 elements and 5 geochemical parameters has reached a world-class level. The project mapped the national baseline graph of 81 parameters in soil, the lithogeochemistry baseline graph of weighted stratum outcrop area as well as the geochemical graph of 76 elements in magmatic rock for the first time. The project also discovered several promising prospecting areas for uranium, rare earth, copper, gold, etc, filling the void in regional geochemical prospecting for sandstone-type uranium deposit and unanalyzed rare earth element deposits. Moreover, the project established a national geochemical baseline for 8 heavy metal elements including cadmium, mercury, arsenic, lead, chromium, copper, nickel and zinc as well as radioactive elements including uranium, thorium and potassium.

Initial Establishment of the Chemical Earth, a Global Geochemical Information Platform (Public Scientific Research Project of the MLR)

The “Chemical Earth” database and the geochemical graphics display model were established, which realized the multi-scale massive geochemical data and graphics management, displayed geochemical maps at different scales, and provided the function of graph and data interactive query and sampling information query. The software “Chemical Earth” V1.0 was developed with completely independent intellectual property rights, and national crust whole-element detection database was built. Parts of

European and American geochemical mapping data were collected, and these data were successfully used for the “Chemical Earth”.



Global geochemical information platform—Chemical Earth

Institute of Karst Geology, CAGS

The Institute of Karst Geology has 215 active employees, 1 is academician, 32 have senior titles, 45 have secondary senior titles, 28 of the active employees have PhDs, 102 have Master’s degrees. The institute has 8 functional departments, 9 research divisions (centers), 2 ministerial key laboratories, 1 key laboratory under the CAGS and 1 key laboratory under the CGS. The International Research Centre on Karst is affiliated to this institute.

Major Research Achievements:

Study on Technologies of Soil and Water Conservation in Peak-cluster Depressions Karst Areas (2011BAC09B02)

This research project was funded by the Ministry of Science and Technology. It clarified the concept, processes and mathematical models of soil and water loss, and systematically revealed for the first time

the reasons and quantitative differences of soil and water loss in different parts and different ecological environments in karst depressions, established erosion intensity grading standards and soil erosion regression models for karst areas, set up soil and water conservation modes and technical regulations for karst depressions with combined of biological and engineering measures, developed eco-storage technology for epikarst water and construction technology of preferred water forest vegetation types and water forest vegetation communities, developed pitaya eco-industry which is good for karst rocky desertification ecological environment and economic benefits. 13 papers were published in 2014, including 5 SCI-indexed, and 2 EI-indexed papers; and 5 postgraduates were supported by the project.

Research of the Distribution Rule of Interlayer Karst Reservoirs in the Tazhong Yingshan Formation

The research project applied the "residual thickness trend surface and impression residual method" to recover the Paleokarst landform and characteristics of the ancient water systems in the Tazhong II area, identified the distribution trend of the third-stage sea level, put forward the concepts of ancient littoral karst and ancient island karst, studied the development mechanism of karst cave systems in different geomorphic units, and proposed the theory of "sea level control on karst reservoir storage", thus providing a basis for the prediction of favorable karst reservoir blocks and deployment of well sites.

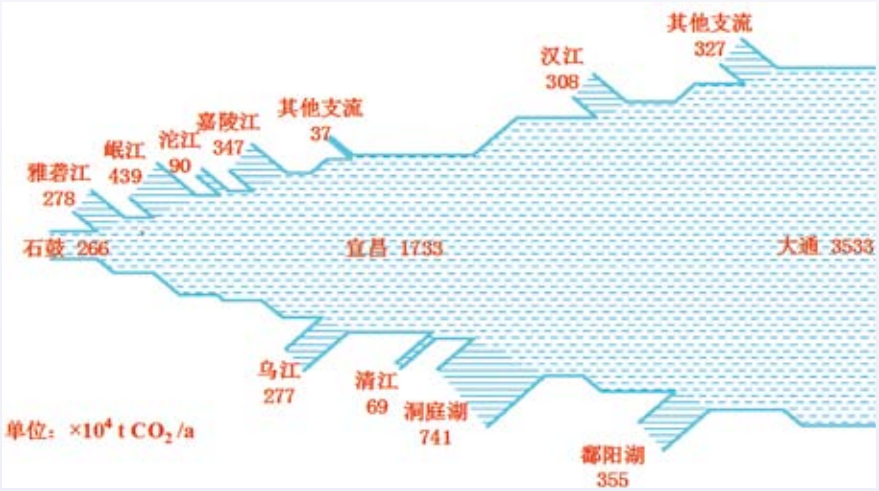
Hydrogeological and Environmental Geological Surveys on a Scale of 1:50000 in Karst Areas of Southwest China (the Dengjiapu and Choushutang quadrangles)

In this geological survey project, we carried out hydrogeological and environmental geological investigations of the Dengjiapu and Choushutang map quadrangles in Hunan Province. The survey area was 917 km^2, 59 large karst springs and 48 underground rivers were investigated. We discovered 15 new large karst springs and 2 new underground rivers, and updated 12 underground rivers with improved working precision. By identifying the hydrogeological conditions in the area, we analyzed the controlling factors and patterns of underground rivers and large karst springs. The results indicate that the development of underground rivers is controlled by structure, lithology and regional hydrological network conditions, and that springs mostly are developed along stratigraphic contact zones or controlled by faults. On the basis of investigation of 35 arid villages, the Yantian, Shuijinping and Shuangpan arid zones were delineated, 10 exploration and development holes and 9 wells were constructed, water scarcity of nearly ten thousand people was solved, and as a result, good social benefits were achieved.

Geological Survey of Karst Carbon Sink in Typical Regions of China

The rock weathering rate and CO_2 consumption in the Yangtze River Basin were calculated through water sample, chemical analysis, in the Yangtze River and its main tributaries. The results showed

that the amount of CO_2 consumption of the Yangtze River Basin is 35.33×10^6 t/a, equaling to 19.62 t/(km^2·a) of CO_2 consumption flux. The effects of coal measure strata and gypsum strata on geological carbon sink of spring systems in northern China were identified, the existence of the Ordovician gypsum interlayers and the coal measure strata that have significant influence on geological carbon sink were revealed by field geological survey in the Liulin Spring system, northern China. To estimate the erosion effect of sulfuric acid on carbonate rock and evaluate the geological carbon sink effect of spring systems accurately, the contribution of SO_4^{2-} in water derived from atmospheric acid deposition, coal measure strata sulfide, sulfide deposits, and gypsum dissolution should be quantified through sulfur isotope analysis. 9 relevant papers were published, including 3 SCI-indexed papers.



A diagram showing the flux of CO_2 consumption of the main stream and major tributaries of the Yangtze River

Investigation and Evaluation of Groundwater Pollution in Karst Regions of Southwest China

The project conducted investigation to further ascertain the water distribution and groundwater types; focused on the analysis of structural characteristics of typical karst groundwater systems; found out the categories and spatial distribution of pollution sources, as well as the variation trend of land utilization. The project completed evaluation of groundwater quality, pollution situation, and capacity and risk of pollution prevention, and finally proposed a classification plan for groundwater pollution prevention and control; established the survey and evaluation information system of groundwater pollution to improve the groundwater environmental supervision capacity; established the groundwater pollution prevention and control system to exert overall control on typical groundwater pollution sources.

Pollution source from a coal mine

Pollution source of wastes

Comprehensive Hydrogeological Survey in Karst Areas of Southwest China

The karst areas in Southwest China involve 8 provinces (municipalities and regions). Based on groundwater distribution, water-cycle mechanism, water quality in different types of karst environments, as well as regional development conditions, such measures were performed as water impoundment by blocking caves, closure of subterranean streams and drilling to carry out development and utilization of karst groundwater and comprehensive control of ecological environment. Six underground reservoirs were built by damming underground rivers and 200 wells were completed, which were able to supply drinking water for over 1 million people and irrigation water for over 3000 hectares of farmland.

Application of the Jinfo Mountain Karst for the World Natural Heritage

The Jinfo Mountain karst is one of four areas of South China karst to be nominated for designation as a world cultural heritage site. The research team did hard work to go through all formalities, communicated with world-renowned experts, and organized geologists both at home and abroad to make investigation and evaluation for the geoscientific and aesthetic value of the Jinfo Mountain, which received positive comments from the experts in karst research, and was identified as a world karst platform model. Owing to joint efforts, the Jinfo Mountain karst, along with three other nominations were included in the World Heritage list at the 36th World Heritage Conference hold in Doha, the capital of Qatar in 2014.

Hanging waterfalls on the second-class steep cliff in Jinfo Mountain

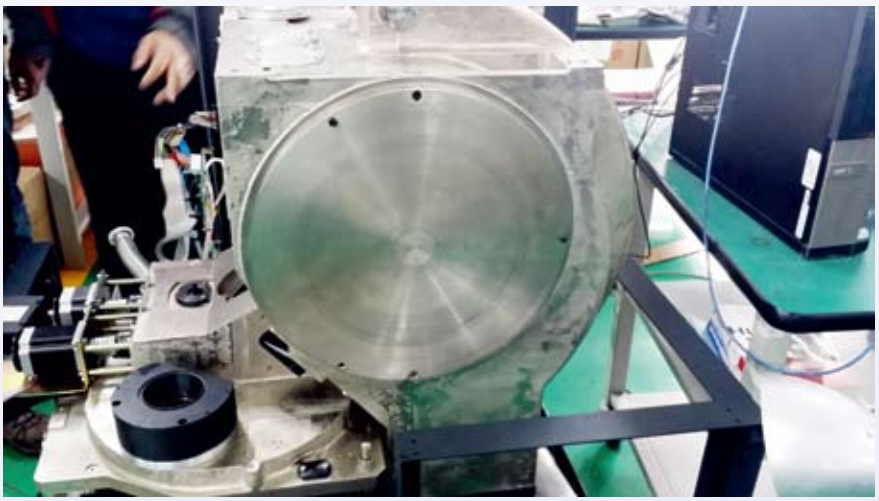
National Research Center for GeoAnalysis (NRCGA)

The NRCGA has 6 functional divisions and offices, 6 research divisions, 1 ministerial key laboratory, 2 key laboratories under the CGS and CAGS respectively, and 1 CGS administrative center. The Commission on Rock and Mineral Analysis of the GSC, the Branch of Geology and Mineral Resources of the Chinese Society for Measurement, the Mineral Resources Analysis Subcommittee of the China National Technical Committee on Standardization of Land and Resources are affiliated with the NRCGA.

Major Research Achievements:

Development and Industrialization of Composite Wavelength/Energy Dispersive X Ray Fluorescence Spectrometer

According to the requirements in design and implementation plans of the project, the emphasis of the project was put on the design of the structure of the X ray fluorescence spectrometer and the manufacture of corresponding key software and hardware. We fulfilled the design and manufacture of model machine with large power high-voltage generator and highly precise goniometer in 2014, whose properties satisfied the design requirements. We achieved the anticipated targets in design assignment and the prototype machine will be assembled and tested shortly. In the course of research, the project group put forward the applications of one patent for invention and two for utility model in China.



Large power high-voltage generator

Research of Key Technology Experiment for Single Mineral and Isotopic Analysis of Important Metals

The research project was successfully completed in 2014. It has done an important job and made a series of innovative results in research and development of many key analytic and experimental technologies, such as new analytic technology for single minerals of important metals and black rock series, key technology for isotope geological analysis and test, analyses of elemental speciation and organic pollutants, urgently-needed experimental technology for marine and continental oil and gas exploration, rapid in-situ analysis and equipment development, and development of standard materials and technical criteria. These technologies are advanced and practical, and have been widely applied in the fields of geology, resources and environment.

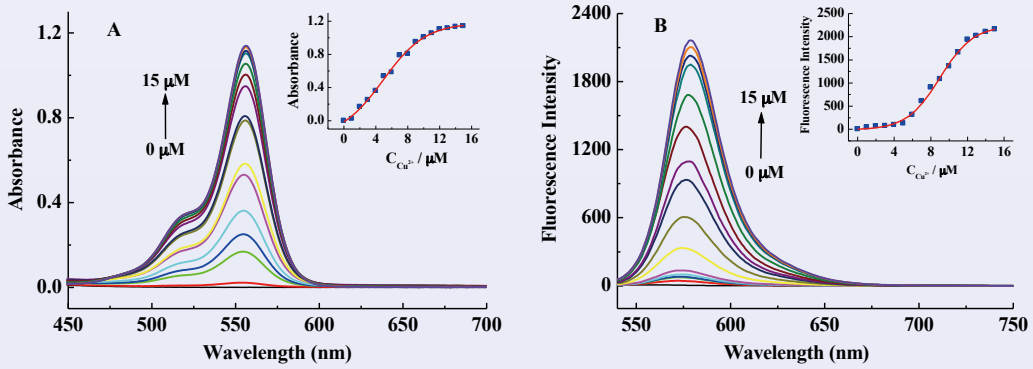
Notable results in the Development of Technical Standards

In 2014, 16 certified reference materials were developed; 4 industrial standards about geological minerals were established, which are analytic methods for biologic samples in eco-geochemistry assessment Part 1 to Part 4; 1 standard of the China Geological Survey was established. The application of those reference materials and reference methods have strongly improved the development of geological experimental technology, and standardized the work of geological experiments. They will have positive effects on exploration and management of geological and mineral resources.

Marked Advance in the Development of Chemosensors for Heavy Metal Ions

The research group developed a novel rhodamine-based Cu (II)-selective chemosensor, N-(2,4-dinitrophenyl) rhodamine B-hydrazide (DNPRH), selecting 2,4-dinitrophenyl as the response group and hydrazine as the bridging agent. The detection limit for Cu^{2+} in absorption and fluorescence spectrum is 7.3×10^{-9} M and 1.1×10^{-9} M, respectively, showing a highly sensitive and selective recognition of Cu^{2+}, on a par with the most advanced international level. The achievement has been awarded for the invention patent of China entitled "the Synthesis and Applications of N-(2,4-dinitrophenyl) rhodamine B-hydrazide", which was authorized by China's State Intellectual Property Office in 2014 (Patent No. ZL 201210323481.0).

The research group reported a novel near-infrared colorimetric and fluorescent Hg^{2+}-selective chemosensor, Si-Rhodamine B Thiolactone (Si-RBS). The maximum emission wavelength of Si-RBS lies in 687 nm and can effectively avoid the background autofluorescence and photobleaching. Other concomitant ions do not exert any disturbance on the measurement of Hg^{2+}. The detection limit for Hg^{2+} in fluorescence method reached 2.48×10^{-10} M. Based on the above mentioned result, an application has been submitted to China's State Intellectual Property Office for the invention patent of China entitled "The synthesis and applications of Si-Rhodamine B thiolactone" (Patent Application No. 201410424312.5).



Intensity of DNPRH reaction to Cu^{2+} (A for UV and B for Fluorescence)

Chapter IV Major Awards for Scientific and Technological Achievements

In 2014, the project of "Breakthroughs in Theoretical and Technological Innovations and Deep Mineral Prospecting in the Jiaodong Area" undertaken by the Institute of Geomechanics, CAGS and other research institutions won the second prize of the National Award for Science and Technology Progress .

The CAGS won 2 first prizes and 9 second prizes of the MLR Award for Science and Technology; 4 provincial and ministerial awards and 2 first prizes and 3 second prizes of the CGS Achievement Award. 2 research achievements were chosen to be in the Top 10 Geological Scientific and Technological Advances by the GSC.

MLR Awards for Science and Technology

Ser. No.	Research project	Investigation organizations	Principal investigators	Award
1	Structure, Evolution and Metallization in the Qinling Orogenic Belt	Institute of Mineral Resources, CAGS, Institute of Geology, CAGS, Peking University, Xi'an Center of CGS, Geological Exploration and Institute of Northwest Geological Exploration and Mining Bureau for Nonferrous Metals	Wang Zongqi, Yan Zhen, Yan Quanren, Wang Tao, Li Qiugen, Chen Juanlu, Wang Ruiting, Xu Xueyi, Xiang Zhongjin, Gao Lianda, Zhang Yingli, Dai Junzhi, Tan Xiaofeng, Wu Fafu, Zhang Hongyuan	First prize
2	Research on Key Technology for Comprehensive Investigation and Mitigation of the Wenchuan Earthquake-induced Geohazards	Institute of Geomechanics, CAGS, China Institute for Geo-Environment Monitoring, CGS, Institute of Geology and Geophysics of CAS, Chengdu University of Technology, China University of Geosciences (Wuhan), Sichuan Institute of geological Survey, Chengdu Center of CGS, Center for Hydrogeological and Environmental Geology of CGS, Institute of Geophysical and Geochemical Exploration, CAGS, Shanghai Jiao Tong University	Yin Yueping, Zhang Yongshuang, Wu Faquan, Wang Yunsheng, Hu Xinli, Wang Jun, Wu Shuren, Yao xin, Sun Ping, Xing Aiguo, Li Hongtao, Tang Wenqing, Fang Hui, Su Shengrui, Wang Tao	First prize

Continued

Ser. No.	Research project	Investigation organizations	Principal investigators	Award
3	Study of Control on Petroleum Distribution by Tectonic Systems, Northwestern China	Institute of Geomechanics, CAGS	Kang Yuzhu, Wang Zongxiu, Zhou Xingui, Kang Zhihong, Wen Zhigang, Li Tao, Li Huijun, Yang Xinde, Xu Yoahui, Yan Xili	Second prize
4	Groundwater Serial Maps of Asia	Institute of Hydrogeology and Environmental Geology, CAGS, China Institute for Geo-Environment Monitoring	Zhang Fawang, Cheng Yanpei, Dong Hua, Huang Zhixing, Tian Tingshan, Ni Zengshi, Gao Yun, Tang Hongcai, Liu Kun, Zhang Jiankang	Second prize
5	Evaluation Index System of the Cyclic Economy in the Realm of Mineral Resources and the Study of the Planning Methods	Chinese Academy of Geological Sciences, Zhengzhou Institute of Multipurpose Utilization of Mineral Resources, CAGS, China Mining Association	Hao Meiying, Zhao Junwei, Ju Jianhua, Guo Min, He Kaitao, Cui Liqiong, Li Liang, Gu Hongshu, Wang Wenli, Yuan Junhong	Second prize
6	Methodology and Application of In-situ Isotopic Microanalysis and Non-traditional isotopes	Institute of Mineral Resources, CAGS	Li Yanhe, Hou Kejun, Qin Yan, Liu Feng, Wan Defang, Fan Changfu, Duan Chao	Second prize

First Prizes of the MLR Award for Science and Technology

(1) Structure, Evolution and Metallization in the Qinling Orogenic Belt

Principal Investigators:

Wang Zongqi, Yan Zhen, Yan Quanren, Wang Tao, Li Qiugen, Chen Junlun, Wang Ruiting, Xu Xueyi, Xiang Zhongjin, Gao Lianda, Zhang Yingli, Dai Junzhi, Qin Xiaofeng, Wu Fafu and Zhang Hongyuan

PI Organizations:

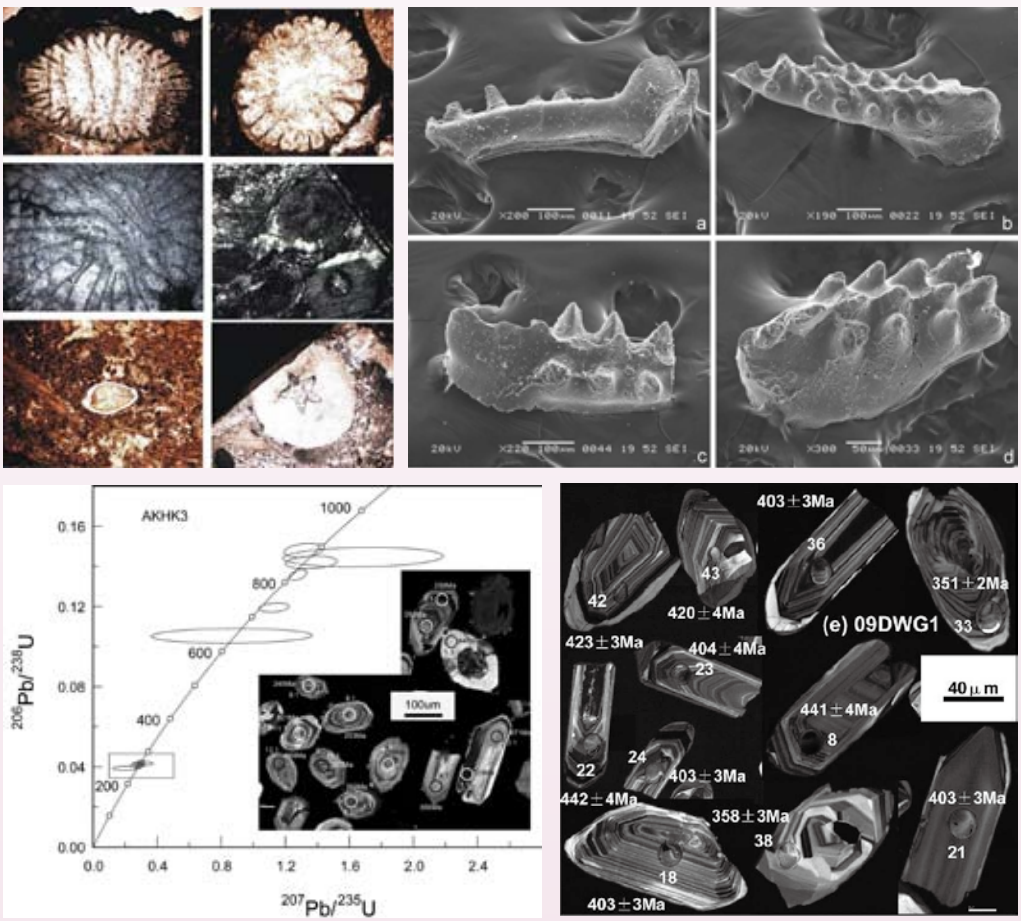
Institute of Mineral Resources, CAGS, Institute of Geology, CAGS, Peking University, Xi'an Center of Geological Survey, CSG, Geological Exploration and Institute of Northwest Geological Exploration and Mining Bureau for Nonferrous Metals

(1) New ideas and methods were obtained on the orogenic belt strata through tectonic-lithofacies analysis in various genetic types of melanges. Paleontologic and isotopic evidence were consistent with each other on key questionable strata of the Qinling belt, reconstructs the framework of the Qinling orogenic belt, and provides new ideas and ways for stratigraphic research in orogenic belts.

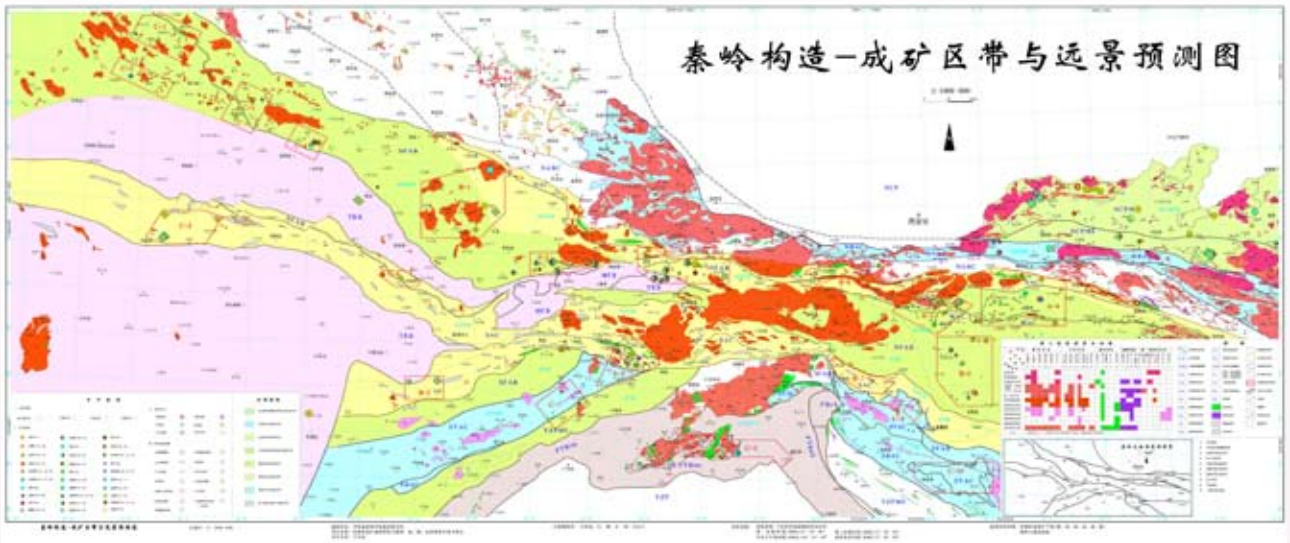
(2) Based on the analysis of tectonic facies and prototype of epicontinental basins, innovations on theory

and means of orogeny structure and evolution were made. Meanwhile, significant tectonic units used to differentiate accretion orogenic processes from collision orogenic processes have been recognized in the Qinling Orogenic belt. At last, a new model of bidirectional subduction in the Qinling Ocean were found, which resulted in the paired arc-basin system to reconstruct its orogenic process.

(3) Based on the corresponding analysis of ore genetic types and tectonic setting, a concept of mineralization-tectonism was found, which enriches the theory of regional metallogeny and exploration. Six tectonic-metallogenetic belts have been predicted, and exploration verification shows good ore-prospects effects in metallogenic belts.



Paleozoic fossils and corresponding isotopic ages of the metamorphic barren strata and questionable strata found in the Kuanping, Taowan, Xixiang, Sanhuashi, Bikou, Hengdan, and Yaolinghe Groups



Recategorization of tectonic units and metallogenic prediction in the Qinling Orogenic Belt

(2) Research on Key Technology for Comprehensive Investigation and Mitigation of the Wenchuan Earthquake-induced Geohazards

Principal Investigators:

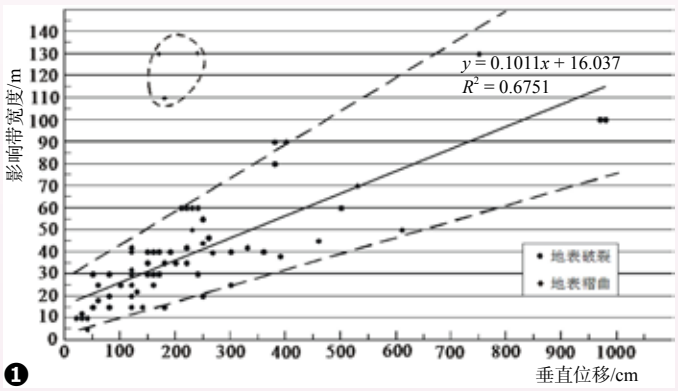
Yin Yueping, Zhang Yongshuang, Wu Faquan, Wang Yunsheng, Hu Xinli, Wang Jun, Wu Shuren, Yao Xin, Sun Ping, Xing Aiguo, Li Hongtao, Tang Wenqing, Fang Hui, Su Shengrui and Wang Tao.

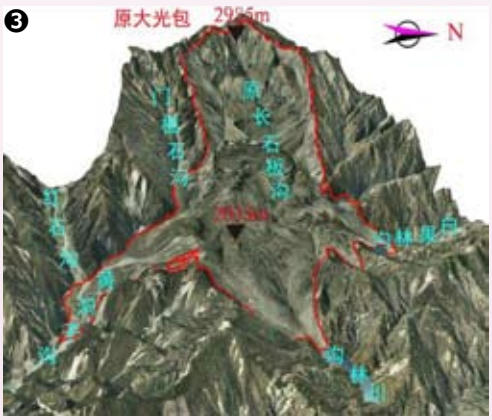
PI Organizations:

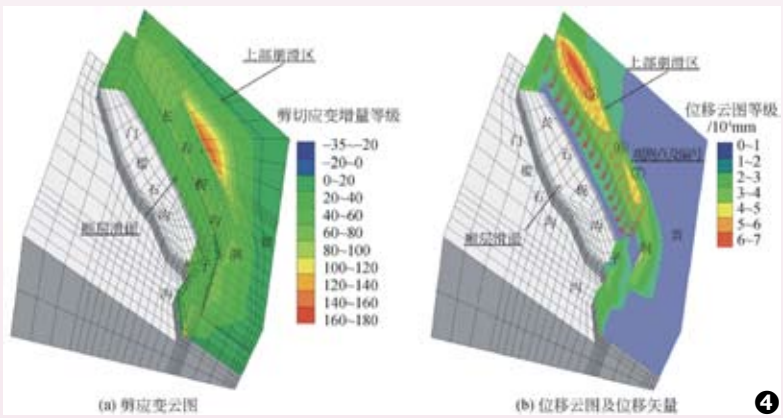
Institute of Geomechanics, CAGS, China Institute for Geo-Environment Monitoring

The research team, headed by Prof. Yin Yueping and Prof. Zhang Yongshuang, adopted multidisciplinary theories and techniques to carry out the research on key technology for comprehensive investigation and mitigation of the Wenchuan earthquake-induced geohazards. The innovative achievements were as follows. (1) The project innovatively integrated the ground survey, geophysical detection and the InSAR technique, and presented the formula for calculating the safe distance from thrust active faults and surface rupture in strong earthquake-hit zone, and completed a systematic survey and summary of the relationship between earthquake-induced geohazards and active faults. (2) Combining a large-scale shaking table experiment, the slope ground motion monitoring and microtremor characteristics tests were conducted firstly to obtain the ground motion amplification law of mountain slopes and to propose the amplification effect of vertical seismic force on mountain stability. (3) Based on the integrated space-aerial-ground emergent survey techniques, the methodology of rapid assessment and mapping of geohazards after the Wenchuan earthquake was established to provide beneficial support for emergent earthquake-induced geohazards response and geohazards prevention during post-

earthquake reconstruction. (4) The wind tunnel and ring shear tests were used to reveal the cushion effect and liquefaction mechanism of high-speed and long-distance sliding in Wenchuan earthquake-induced landslides, and establish the early indicators for identifying the post-earthquake high-position debris flows. These achievements have been used to guide the emergency treatment of earthquake-induced geohazards and post-earthquake reconstruction in earthquake-hit zones, such as the Wenchuan earthquake, Yushu earthquake, Lushan earthquake, and significantly improve the capability of geohazards monitoring and early warning in mountainous zones of China, and effectively avoid heavy casualties.







❶ Relationship between the vertical displacement and width of the influenced zone of earthquake ruptures

❷ Photos showing earthquake ruptures and the width of the influenced zone

❸ The UAV 3-D image of the Daguangbao rockslide

❹ Simulation result of the Daguangbao rockslide during the second phase (40~70s) of the Wenchuan earthquake

❺ Unmanned aerial image of the Wenjiagou debris flow in Qingping Town, Mianzhu City

Second Prizes of the MLR Award for Science and Technology

(1) Study of Control on Petroleum Distribution by Tectonic Systems, Northwestern China

Principal Investigators:

Kang Yuzhu, Wang Zongxiu, Zhou Xingui, Kang Zhihong,Wen Zhigang, Li Tao and Li Huijun et al.

PI Organizations:

Institute of Geomechanics, CAGS

The main tectonic systems in northwestern China were systematically categorized, such as, the Latitudinal System, West-Region System, Hexi System, "ξ"-type system, "ε"-type system, and Longitudinal System. Detailed study was carried out on the architecture, shape, distribution, scale, evolution and its six fundamental characteristics–intermittence, inheritance, migration, differentiation, transformation and complexity. And then six junction types of tectonic systems were drawn: diagonal junction, reversal junction, truncation junction, overlap junction, inclusive junction and reworked junction.

Prototype basins under former tectonic systems were reconstructed, which shed light on the characteristics of tectonic stress-field of those basins in western China. Based on the study of tectonic system controls on basin types, petroleum sources, petroleum-bearing systems and petroleum accumulation plays, six low-order shear structure dominated oil and gas field distribution models were set up: brush structural, rotation and shear structural, en-echelon structural, "reversed S"-type, "λ"- type and imbricate structural.

This study confirmed that regional metamorphism did not happen to Paleozoic formations in basins of northwestern China; oil seepage firstly discovered in Carboniferous formations of the Qaidam Basin and other pool-forming factors proved giant petroleum potential in poorly explored Carboniferous to Permian formations in northwestern China.

Based on the study above, combined with pool-forming factors, prospect appraisals were carried out on main basins in northwestern China, outlining favorable petroleum accumulations.

This study contributed to the theory of geodynamics and petroleum geology, and it also led to the discovery of 5 major oil and gas fields and over 10 medium-small oil and gas fields in the first order favorable zones. It shows great significance to both theoretical study and practical application of tectonic system study.

(2) Groundwater Serial Maps of Asia

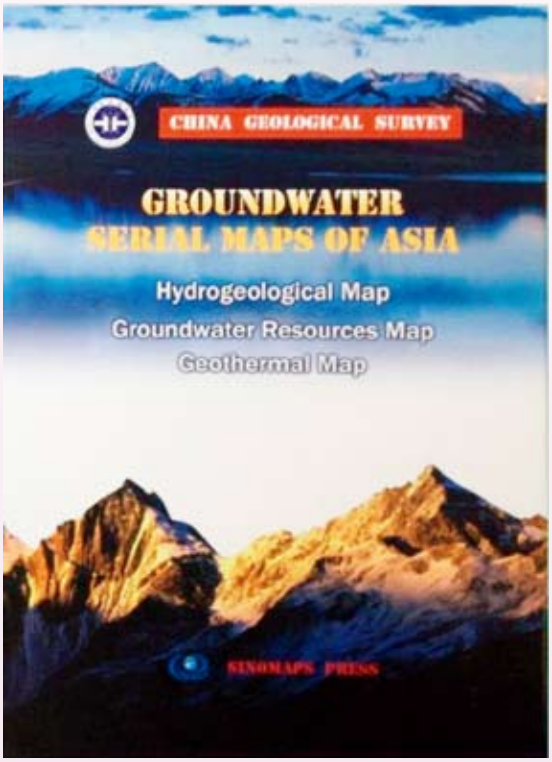
Principal Investigators:

Zhang Fawang, Cheng Yanpei, Dong Hua, Huang Zhixing, Tian Tingshan, Ni Zengshi, Gao Yun, Tang Hongcai, Liu Kun and Zhang Jiankang

PI Organizations:

Institute of Hydrogeology and Environmental Geology, CAGS and China Institute for Geo-Environment Monitoring

This was a research achievement of the geological survey project "Groundwater Resources and Environmental Geology Serial Maps of Asia" and the period was between 2008 and 2010. These Serial Maps developed the categorization of the groundwater system and revealed groundwater circulation characteristics of Asia. It established the groundwater resources and space environment information system of Asia and achieved innovation in intercontinental groundwater mapping and research methods. These Serial Maps filled the Asian region's gap in intercontinental groundwater resources and environment geology series maps and built a groundwater resources and environment information platform in Asia. It provides a scientific basis for natural resources development and utilization, water resources planning, geological environmental protection and disaster prevention and mitigation in Asia. These Serial Maps are characterized by fundamentality, comprehensiveness, and extensive applicability. This international achievement will play an important role in water resources research in Asia and the world. It has an extremely profound political and scientific significance on dealing with the international resources and environmental conflicts.



Groundwater Serial Maps of Asia

Hydrogeological Map of Asia

Groundwater Resources Map of Asia

(3) Study of Evaluation Index System of the Cyclic Economy and Planning Methods in the Realm of Mineral Resources

Principal Investigators: Hao Meiying, Zhao Junwei, Ju Jianhua, Guo Min, He Kaitao, Cui Liqiong, Li Liang, Gu Hongshu, Wang Wengli and Yuan Junhong

PI Organizations:

Chinese Academy of Geological Sciences, Zhengzhou Institute of Multipurpose Utilization of Mineral Resources, CAGS, China Mining Association

In accordance with the need of the national economic development, the research group put forward an evaluation index system of the cyclic economy in the realm of mineral resources of China, development patterns of cyclic economy in mining cities and key industries of China, and six policy recommendations for promoting the industrialization of bulk mill tailings and mining mullocks in China; compiled and published *Technical Compilation of Encouragement*, *Limitation and Elimination on the Conservation and Comprehensive Utilization of Mineral Resources*, developed the "Technical catalog of encouragement, limitation and elimination on the conservation and comprehensive utilization of mineral resources", which were issued by the MLR of China ("No. 146 (2010) issued by the MLR"), and played an important role in the implementation of the "Specific Project of Conservation and Comprehensive Utilization of Mineral Resources". Key technical questions on the comprehensive utilization of mineral resources and ten technical systems of priority to development were put forward; a memoir of "New techniques and application of geological survey should be encouraged in order to implement the conservation of energy resources" was published. The study results laid a foundation for the compilation of *Project of Mineral Resources in China (2008-2015), The Twelfth Five-Year Guideline for the Conservation and Comprehensive Utilization of Mineral Resources*, and provided a strong technical support for the exertion of government functions of the Ministry of Land and Resources.

Published *Technical Compilation of Encouragement, Limitation and Elimination on the Conservation and Comprehensive Utilization of Mineral Resources*

(4) Methodology and Application of In Situ Isotopic Microanalysis and Non-traditional Isotopes

Principal Investigators:

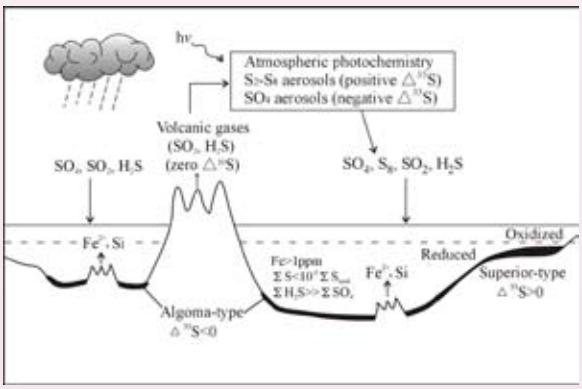
Li Yanhe, Hou Kejun, Qin Yan, Liu Feng, Wan Defang, Fan Changfu and Duan Chao

PI Organizations:

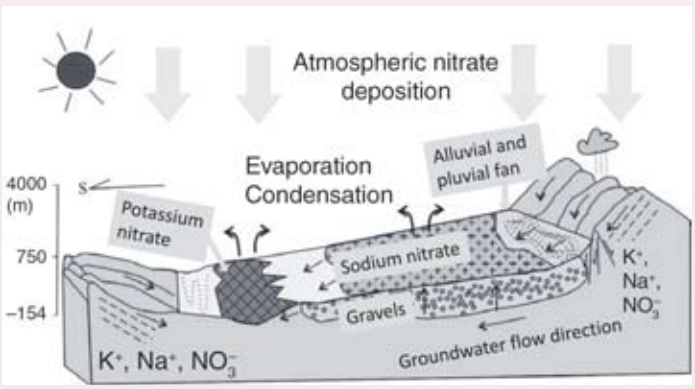
Institute of Mineral Resources, CAGS

Aiming at the international frontier, we established the first analytic methods of triple oxygen isotopic composition in nitrate and sulfate, and the first in situ B isotopic microanalysis using LA-MC-ICPMS in China. We also set up methodology for zircon U-Pb dating and Hf, Fe, Cu and Zn isotopic analysis using LA-MC-ICPMS. The precision and accuracy of these methods are close to the state of the art of laboratories worldwide.

We discovered firstly obvious mass independent fractionation in triple oxygen isotopes of the nitrate deposit in the Turpan-Hami area, which indicated its atmospheric origin, transportation and evolution trajectories. Then a mineralization model of atmospheric nitrate deposit was set up. According to Fe, Si and O isotopic compositions and mass independent fractionation of multiple S isotopes, we suggested that Precambrian banded iron formation (BIF) was formed by submarine exhalation on the ancient Earth. A set of rhythmic layer stands for one marine exhalation activity. Algoma- and Superior-types BIFs were formed at the same stage with different transition phases. We proposed a metallogenic model for BIFs and a mechanism for the formation of Si-Fe rhythmic layers.



The BIFs formation model



A conceptual model for nitrate deposits and their corresponding geographic factors in the Turpan-Hami area

Chapter V CAGS Xinhualian Science and Technology Award

In 2014, the third conferral of the CAGS Xinhualian(Macrolink Group) Science and Technology Award was given to 13 researchers of the Academy, among whom Yang Jingsui, Zhao Yiming, Yang Zhenyu and Dong Shuwen received the outstanding achievement prizes with a bonus of 100,000 Yuan each; Wang Denghong, Yao Jianxin, Zhang Qin, Zhang Zhaoji, Zhang Cheng, Xiao Keyan, Zhang Yongshuang, Yang Yongliang and Hao Ziguo received the outstanding contribution prize with a bonus of 50,000 Yuan each.

Leaders of the MLR, Macrolink Group and CAGS confer outstanding achievement prizes of the CAGS Xinhualian Science and Technology Award at the third award ceremony

1 Outstanding Achievement Prizes of the CAGS Xinhualian Science and Technology Award

Yang Jingsui, Professor at the Institute of Geology, CAGS, has worked extensively on problems of the petrology and tectonics of the Tibet Plateau and other orogenic belts. His innovative research areas include the study of ophiolites, mantle rocks and ultrahigh pressure metamorphic belts (UHPMB) of China, active continental margin architecture, and recognition of tectonic boundaries and lithologic units of the Tibet Plateau. He has proposed the existence of two giant UHPMB and two stages of UHP metamorphism within the Central orogenic belt of China based on the recognition of newly discovered UHPMB on the north margin of the Qaidam block, western China and the eastern Qinling orogen. He has also proposed a new occurrence of diamonds on Earth (ophiolite-hosted diamonds) based on the discovery of ultrahigh pressure minerals in ophiolites from Tibet, the Polar Urals, Myanmar and other localities. He is a recipient of the Second Class Award of National Natural Science Foundation, the First Class Award of Science and Technology from the MLR, and the Award of Scientific and Technological Process from the HLHL Foundation of Hong Kong. He has been a Fellow of the Mineralogical Society of America and the Geological Society of America since 2011.

Yang Jingsui on field geological investigation in an ophiolite and chromite district in the Polar Urals, Russia

Zhao Yiming, is a research fellow of the Institute of Mineral Resources, CAGS. As an economic geologist, he has been studying metalliferous deposits and geochemistry for a long time, and is playing a leading role in the investigation of iron ore deposits and skarn deposits in China.

Cooperated with late Academician Cheng Yuqi, he has summed up the iron ore deposits of China many times, and raised the research to the advanced world level.

Based on the study of numerous skarn deposits of China and in comparison with typical skarn deposits around the world, he proposed two new skarn formations, i.e. manganoan and alkaline skarn formations.

In 1965, he discovered widespread albitization and scapolitization of endocontact zones of diorite in the Tieshan iron skarn deposit, Hubei Province, and proposed that the natrium metasomatism in endocontact zones is a very important ore-searching indicator for iron skarn deposits.

He has discovered magnesian skarn formed in the magmatic stage, and more than 10 rare metasomatic minerals for the first time in China, such as aluminodiopside, danburite, johannsenite, boron-vesuvuanite, water-bearing custerite, magnesioferrite, and manganpyrosmalite.

He published more than 100 papers and 10 monographs. As chief editor, he published 8 monometallic resources maps of China, involving Fe, Cu, Pb-Zn, W-Sn, Hg-Sb, Au, Ag, and rare earth metals.

In recent years, his group discovered a large new anatase ore deposit in Inner Mongolia, and have done related exploration and research work on this deposit.

His achievements in scientific research won 5 second prizes of Science and Technology Award of Ministry of Geology and Mineral Resources and Ministry of Land and Resources. He received two prizes of Outstanding Books Award, and a title of Model Worker in the national geological and mineral industry in 1985.

Zhao Yiming (right) on the prospecting site of the Moshishan anatase ore deposit in Inner Mongolia

Yang Zhenyu, serves as a research director and Ph.D. student advisor in the Institute of Geomechanics, and is also the director of the Key Laboratory of Paleomagnetism and Tectonic Reconstruction of the MLR of China. He has carried out research on tectonics and paleomagnetism, and managed several important projects, e.g. the outstanding young scientist fund and key project of the NSFC, the preparatory research fund of National Basic Research Program of China. Tectonic evolution in East Asia and Southeast Asia, including tectonic migration, collision and amalgamation of three blocks (e.g. North China block, South China block and Indochina block) are his main research targets. The extrusion of the Indochina block resulted from the collision between Indian and Eurasian plates was evidenced by the Cretaceous and early Tertiary paleomagnetic results. Paleo-geomagnetic field changes, e.g. reversal frequency in different geological times, were studied through magnetic stratigraphy in the Early Jurassic, the boundary between the Cambrian and Ordovician, and the Middle Ordovician. His finding shows that high and lower frequencies in the Early Jurassic and Middle Ordovician, respectively, provide the prominent characteristics for geodynamo research. The latter is used to constrain the paleogeographic affinities between North China, South China and Gondwana. He has published over 140 papers, including more than 70 papers in the international peer-reviewed journals. He was awarded the T.K. Huang's Geologic Science and Technology Prize by the GSC in 2002.

Yang Zhenyu on an investigation in the Permian Great Igneous Province in Norilsk, Siberia

Dong Shuwen, research fellow of the CAGS, Ph.D supervisor, Academician of the Erfurt Academy of Science, Germany, and Honorary Fellow of Geological Society of America. Now, he serves at the CAGS as Vice President, Deputy Director of Committee of Science and Technology, and Deputy Director of Committee of Scholastic Degree, and also Member of Executive Committee and Treasurer of the International Union of Geological Sciences (IUGS), Member of the Scientific Board of International Geoscience Program (IGCP), UNESCO/IUGS; Secretary-General of the China Committee for IGCP , foreign member of the IRIS of USA, Editor-in-Chief of Acta Geoscientica Sinica and so on.

He has made contributions to the following research fields: exploring deep structures and mechanisms of metallogeny, guiding geological work to make breakthroughs in funding deep mineral deposits in the lower and middle valleys of the Yangtze River. He systematically proposed a model "Multi-plate convergence in East Asia in the Late Jurassic" and a completely new explanation for the conception "Yanshanian Movement". By closely combining geology with geophysics, he initiated the SinoProbe Program, a national project of deep exploration in China during 2008—2014.

He has actively participated in international cooperation and competition on the stage of international academic exchanges and geoscientific research, and has won an honor and a high position for China. He has published more than 180 academic papers and 5 monographs. He received the first prize of Award for Science and Technology Progress of the MLR, National Award for Outstanding Scientific Workers Engaged in Field Investigation, Award for Scientific and Technological Youths issued by Anhui Province, National Award for Scientific and Technological Youths and Gold-Hammer Award of the GSC and so on.

Dong Shuwen in field work in the Qilian Mountains

2 Outstanding Contribution Prizes of the CAGS Xinhualian Science and Technology Award

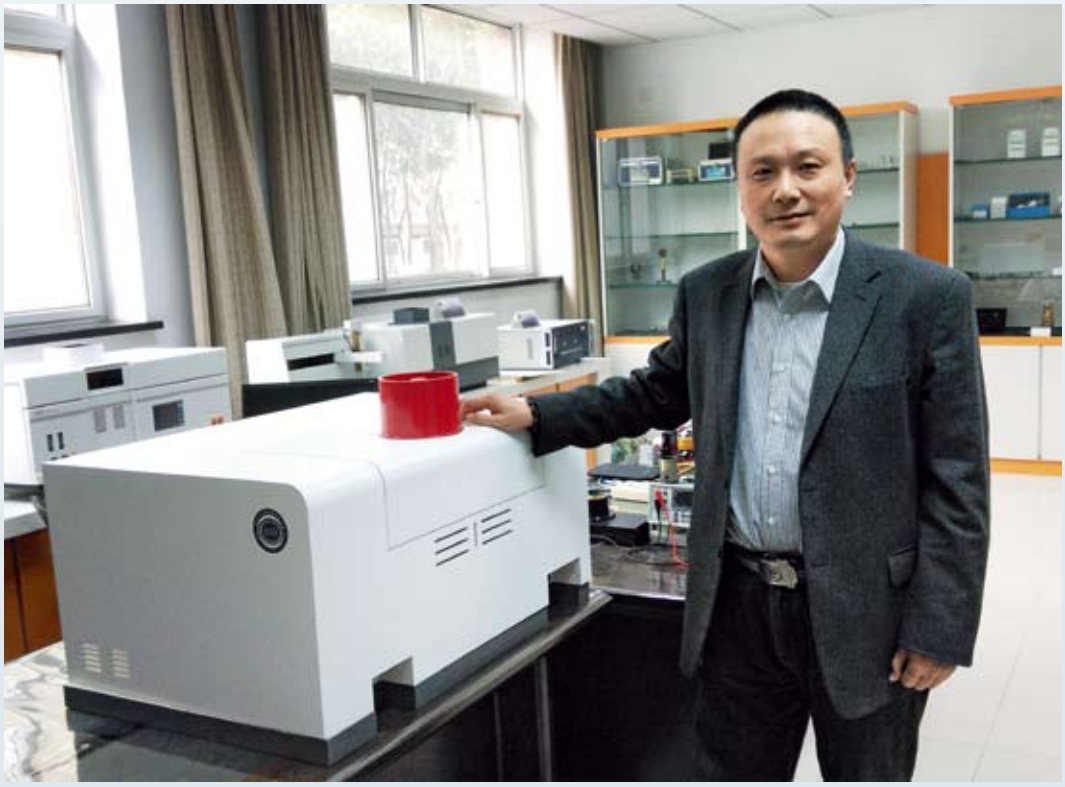
Wang Denghong, research fellow of the Institute of Mineral Resources, CAGS, director of the Rare Metal-Rare Earth and Precious Metals Research Division, mainly engaged in geological work related to mineral resources, focusing on regional metallogenic regularity and metallogenic prediction, metallogenic series and mineralization system, plume-related mineralization, massive sulfide deposits, pegmatite deposits and orogeny, PGE deposits, regional metallogenic regularity (especially in the Altay region and the Nanling region), strategic study on rare metals, rare earth and other critical mineral resources. Based on investigation and research of more than 550 domestic and international mineral deposits, he and his research group have contributed a lot to establishing the "China metallogenic system", which is considered to be one of the most important innovations of the new century in earth sciences in China. Being the first author, he published more than 10 books such as *Mantle Plume and Mineralization, Cenozoic Mineralization in China; Metallogenic Systems and Regularity of the Altay Metallogenic Province; Research on Mineralization Potential and Comprehensive Detection Technology of Non-ferrous and Precious Metal Resource in Nanling, China; and Geology, Geochemistry and Prospecting of PGE Deposits in Southwestern China*, as well as more than 110 papers. He was among the first batch of scientists chosen by the National New Century 100-1000-10000 Talents Program in 2004, obtained the government special allowances and won the second prize of the National Award for Science and Technology Progress in 2008, Top 10 Geological Prospecting Achievement Award of the GSC in 2009, Top Ten Geological Science and Technology Advances Award and the fifth conferral of the T.K. Huang's Young Geological Scientist Prize in 2010.

Wang Denghong makes investigation in the Huize Pb-Zn deposit in Yunnan Province

Yao Jianxin, research fellow of the Institute of Geology, CAGS, post-graduate supervisor, deputy director of the Paleontological Society of China, councilor of the GSC, secretary-general of the Subcommission on Stratigraphy and Paleontology, GSC, a corresponding member of the Subcommission on Triassic Stratigraphy, International Commission on Stratigraphy, associate editor-in-chief of Acta Geologica Sinica (China Edition), member of the China National Committee for Terms in Sciences and Technologies. He was a senior visitor of the Japan Society for the Promotion of Science (JSPS) and guest Professor of Journal of Geosciences, Osaka City University during 1999—2000. He has conducted research on stratigraphy and paleontology and is responsible for 20 projects funded by the MST, NNSFC and CGS. He has obtained important achievements on conodont biofacies, quantitative stratigraphic correlation between South China and Tibet, the relationship between mass biotic extinction and geological events in the Permian-Triassic period, stratigraphic correlation between different regions, establishment of the Triassic stratigraphic standard; and has achieved the first prize of the MLR Award for Science and Technology in 2010.

Yao Jianxin makes investigation in the West Kunlun Mountains

Zhang Qin, research fellow of the Institute of Geophysical and Geochemical Exploration, CAGS, director of the Central Laboratory and general manager of Kaiyuan Corporation. He has long been engaged in the research and development of analytic instruments, reference materials, analytic methods and techniques for geochemical samples. He developed an analytic scheme and quality monitoring system for 76 elements in exploration geochemical samples, which established a foundation for some great projects, such as geochemical mapping of 76 elements, multi-target geochemical survey, and full elements detection of earth's crust. The results have been extensively applied in many geological laboratories of China. Outstanding contributions have been made in the promotion and application of new methods and technologies (including ICP-MS, XRF, ICP-OES) in the geological and mining industries, and also in the promotion of modern analytic technologies widely used in the field of land and resources. He published more than 90 papers, participated in compiling 3 monographs, and drawing up 1 national standard and 2 industry standards. He received 6 national utility model patents, 1 first prize and 5 second prizes of the MLR Award for Science and Technology.



New-type full-automatic gas-generation atomic fuorescence spectroscopy developed by Zhang Qin

Zhang Zhaoji, senior researcher in the Institute of Hydrogeology and Environmental Geology, CAGS. He has long been engaged in hydro-geological and geo-environmental research in the North China Plain area. Dr. Zhang has undertaken one key project funded by the Japanese Department of Environment, three national geological survey projects and finished, together with other PIs, a national key fundamental research project "Groundwater evolution mechanism and its adjustment in the North China Plain" in coordinated efforts, focusing on systematic research on groundwater system, evolution, land and water resources utilization, eco-environmental evolution, groundwater pollution, etc. New progress and some world-class advances have been achieved, which have received widespread recognition and are listed in the list of the top ten scientific advances of the CAGS and GSC. He has also been awarded the first prize of MLR Award for Science and Technology and second prize of Science and Technology Award issued by Hebei Province.

Zhang Zhaoji on an investigation in the Ya'an earthquake area

Zhang Cheng, research fellow of the Institute of Karst Geology, CAGS, doctoral tutor, member of the Scientific Board of IGCP. He has been engaged in the research field of karst geochemistry, karst carbon cycle and global change, hydrological geology and land use. As research group head, he successively completed several national/provincial level projects supported by four ministries (foundations) in China and karst IGCP projects, focusing on comparative study on karst geochemistry and karst process. These research projects revealed that karstification is a kind of special geological process involved in the short-term scale carbon cycle, and is of positive significance for the modification of the global carbon cycle model. It also proved that vegetation restoration (rock desertification rehabilitation) can significantly improve the condition of the epikarst dynamic system, thus providing a scientific basis for manual intervention in karst carbon sink potential estimation. He is actively involved in karst-related IGCP projects for many years and has gained rich experience in IGCP bilateral and multilateral international cooperation. He has conducted research on carbon sequestration effect of aquatic plants, confirming that photosynthesis of aquatic plants is an important component of the karst carbon sink in surface rivers in karst regions. His research results have been well recognized and won a number of science and technology awards and geological survey achievement awards from the MLR and CGS respectively.

Zhang Cheng on an investigation in a karst area in southern Spain

Xiao Keyan, research fellow of the Institute of Mineral Resources, CAGS. He has been engaged in quantitative mineralization prediction and exploration, and has hosted and participated in over 30 national research projects, including the National 863 Project, national science and technology projects and geological surveys. His scientific research focuses on development and practice of the metallogenic prognosis theory, mineral resources evaluation system, quantitative model and GIS application. In recent years, sponsored by national science and technology projects, a mineral prediction method system of metallogenic series based on integrated information was developed, which has played an effective guiding role in making breakthroughs in exploration of the Jiama deposit in Tibet and the Caixiashan deposit in East Tianshan. He studied and compiled the guidance and technical requirements for mineral prediction and evaluation methods, and guided the evaluation of mineral potentiality of 25 ores in China. He developed a mineral prediction and evaluation system that takes a leading position in China, and it has become the standard software for geologists and students engaged in mineral prediction. He has been praised and rewarded by related departments many times, such as national and ministerial awards for science and technology progress, government special allowances for science and technology, a title of the cross-century technology talent of the MLR and one of the scientists chosen by the National New Century 100-1000-10000 Talents Program in 2004.

Xiao Keyan makes an investigation in the Kumtag molybdenum deposit in Xinjiang

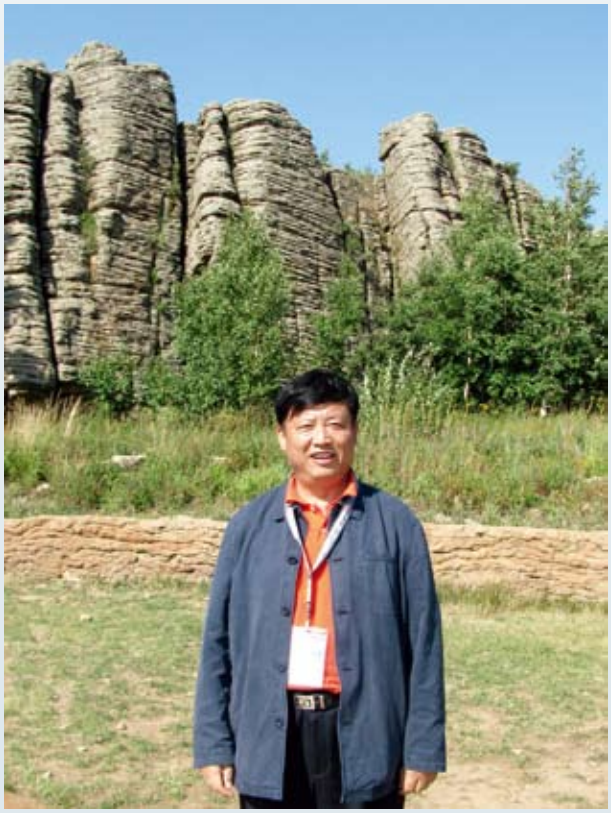
Zhang Yongshuang, is a research professor, also a doctoral supervisor at the Institute of Geomechanics, CAGS. He has devoted himself to the study of engineering geology and geohazards for 20 years. Prof. Zhang, as head of research groups, carried out more than 20 national and provincial-level research projects and published 133 scientific papers. His major scientific research achievements are as follows: (1) Based on the plan and construction of major engineering projects in the Tibetan Plateau and its adjacent areas, he put forward a research approach on coupling the regional crustal stability and engineering geological stability, which enhanced the vitality and practical purpose of the traditional disciplines. (2) He has done leading research on altered soft rock and related engineering problems in the southeastern Tibetan plateau. Some corresponding identification indexes have been provided and taken into account during engineering design. (3) In recent years, he has further summarized the manifestations of geohazard effects of active faults, emphasized the coupling between endogenic and exogenic geological processes and their impact on geohazard occurrence. These realizations have promoted theoretical research of geohazard prevention in high intensity mountainous areas. Considering his above achievements, he was awarded 2 first-class and 1 second-class ministerial-level prizes, as well as the T.K. Huang's Young Geological Scientist Prize. He was also won the honorary title of National Model in Earthquake Relief Work by the Party Central Committee, the State Council and the Central Military Commission.

Zhang Yongshaung on a field investigation in the Longmenshan region

Yang Yongliang, research fellow at the National Research Center for GeoAnalysis. He has long been engaged in marine isotope geochemistry and environmental geochemistry research. As head of research groups, he has conducted 1 key international S&T cooperation project, 3 National Natural Science Fund Projects, 1 National Program for Science and Technology Development, 1 National R&D Infrastructure and Facility Development Program, and 1 provincial natural science foundation project. He has for the first time in China carried out eco-geochemical research of dioxins, polybrominated diphenyl ethers and polychlorinated naphthalene and other persistent organic pollutants of China's offshore environment, and geochemical tracer method study with cosmic ray origin nuclides 7Be and 10Be in the East Asian monsoon region. His research results revealed the 10Be isotope evidence in the Okinawa Trough; proved that black tide still flowed during the last glaciation; showed that the average concentration of 7Be in the near-surface atmospheric aerosol in the East Asian monsoon region presents a normal distribution in latitudes, and the maximum concentration is reached in mid-latitudes of China.

Yang Yongliang collects water specimens in a high-altitude region in Balangshan Mountain, Sichuan Province

Hao Ziguo, research fellow in the CAGS, now executive director of the China Editorial Society of Sci-Tech Journals, and director and secretary general of the Professional Committee of Geological Sci-Tech Journals, GSC. He has long been engaged in management of geological sci-tech journal editing and publication, and has made outstanding contributions to internationalization, quality improvement and online services of Chinese geological journals. The journal *Acta Geologic Sinica* (English Edition) was selected by 22 databases and websites at home and abroad, such as the famous SCI and CA databases. It is China's first geological journal selected by the SCI with an impact factor greater than 1.0, and ranks first among Chinese geological journals throughout the year, belonging to leading geological journals of the middle-upper level all over the world. *Acta Geologic Sinica* (both Chinese and English editions) has won the National Journal Award, the first and second prizes of Outstanding Sci-Tech Journals, the top 100 Chinese Outstanding Academic Journals, the first prize of the Chinese Excellent Sci-Tech Journal Project, Chinese Sci-Tech Journal with High Impact Factors, both the National Journal Award and National Journal Award (Nomination Award), the Most Influential Sci-Tech Journals over the past 60 Years, and China's Most Influential International Sci-Tech Journals. He has led an editorial team of the highest level recognized by China's science and technology communities. In addition, he has creatively built the Portal Website of Chinese Geoscience Journals, which is the largest single-subject academic website in China. This website has been visited 21.50 million times during the past 5 years, and possesses a large number of readers from more than 20 countries who download papers from it. This has opened a new way for the dissemination of China's geological sci-tech achievements, promoted the establishment of a series of single-subject websites, and thus has attracted great interest in many aspects. He has won the Government Special Allowances, was chosen as one of the fifth National Excellent Publishers by the General Administration of Press and Publication, received the title of Influential Journal Editors-in-Chief Over the Past 60 Years and the second batch of the Leading Talents in News and Publishing Industry.



Hao Ziguo makes investigation in a geopark— the Asihatu Stone Forest

Chapter VI Top 10 Geological Scientific and Technological Advances

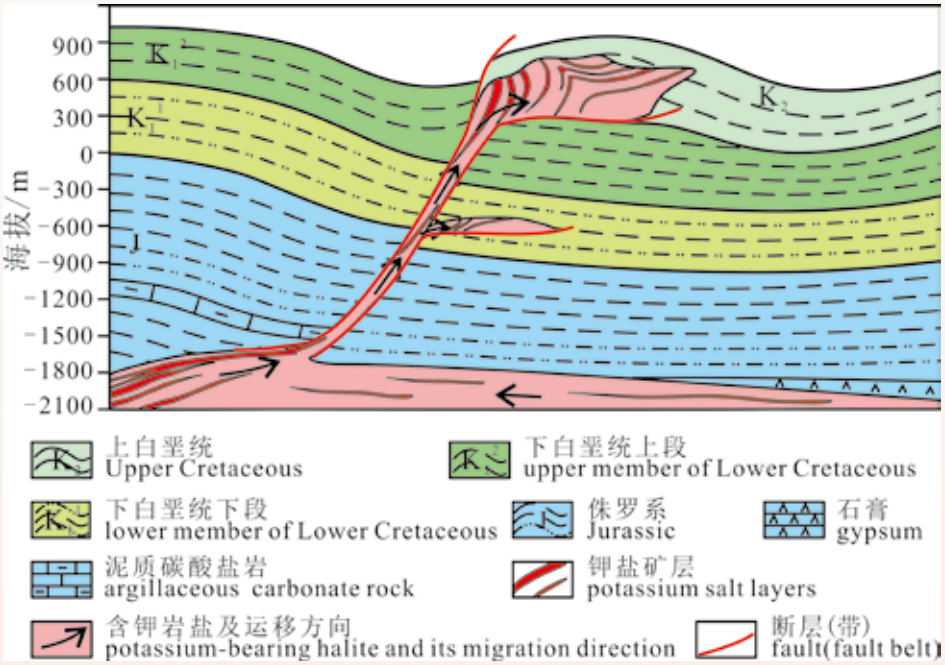
The top 10 geological scientific and technological advances in 2014 were selected from 45 submitted research projects by 35 academicians and experts from the MLR, MST, ME, CAS and NNSFC, and announced in January 2015 by the CGS and CAGS. These 10 advances are as follows: (1) Great progress in potash exploration in China; (2) A new idea which led to the discovery of light oil in the volcanic formation of the Tuquan Basin in the peripheral area of the Songliao Basin; (3) Successful sea trial of the "HAIMA" ROV at a depth of 4500 m; (4) Breakthrough in chromite prospecting based on new findings in Norbusa, Tibet; (5) Modernized sampling and analysis technology system established for the investigation of groundwater pollution in China; (6) Discovery of currently the world's largest nothosaurs skulls and nothosauria underwater foraging footprints; (7) The oldest zircon in Asia discovered in the Cathaysian Block; (8) Structure and evolution of ancient continental crust of the North China craton; (9) The marine geological survey of 1 : 1 million scale completed in China sea; (10) Significant achievements of the Wenchuan earthquake faulting research.

These achievements taken together demonstrate the significant progress of geological investigation and geoscientific study throughout China and fully embody the capability and level of the scientific innovation and industrial application of geological investigation work. Four projects of the above top 10 advances were coordinated by or under the auspices of the CAGS, which are detailed below.

1 Great Progress in Potash Exploration in China

New type gravel potassium-rich brine formations have been found in the early Quaternary strata in the piedmont of the Altun Mountains in the western Qaidam Basin by a salt lake exploration team led by Prof. Zheng Mianping (academician of the Chinese Academy of Engineering) of the Institute of Mineral Resources, CAGS, together with the Qaidam Comprehensive Exploration Institute of Geology and Mineral Resources, which was jointly supported by the geological survey project and the key project of the National Natural Science Foundation of China. The brine formations have resource quantity of 0.35 billion tons, estimated by drilling data, and are expected to become a potash deposit base in China. In the Kuqa depression of the Tarim Basin, a Paleogene potash-bearing seam, about 100 m thick, was discovered, with a 41 m-thick salt (KCl) bed, which reaches the industrial grade. In the Sichuan Basin,

Triassic polyhalite was found, which is an important source of potassium in deep potassium-abundant brine, and a precious slow-release fertilizer as well. In the Upper Yangtze River Basin, evaluation was conducted for 13 potassium-rich brine deposits of brine-bearing structure, with an estimation of 49.17 million tons of KCl resources. In Mengyejing, southwestern Yunnan Province, a "two-storey building" metallogenic model for potash was established, and this greatly helps to narrow the target region for potash-finding in the Ordovician salt basin in northern Shaanxi Province, bringing hope to breakthroughs in marine potash exploration in China.



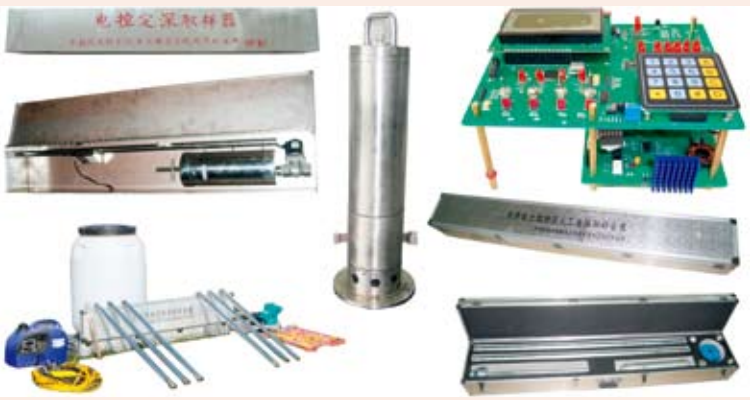
"Two-storey building" potash-forming model

Salt-picking section in Qarham, Qinghai Province

2 Modernized Sampling and Analysis Technology System Established for the Investigation of Groundwater Pollution in China

This work was led by the Institute of Hydrogeology and Environmental Geology, CAGS with the participation of the National Research Center for GeoAnalysis, China University of Geosciences (Beijing), Northwest University and Tsinghua University. Under the auspices of the China Geological Survey Program, researcher Sun Jichao, associate researcher Liu Jingtao and their group successfully developed the series sampling device and overcame the problem in the sampling of trace components. Efficient field survey technology and offline extraction technology were developed and used to quickly and accurately identify groundwater pollution situation in key areas. High resolution remote sensing data was interpreted to identify land use types and pollution sources. An organic analysis platform was established to achieve network monitoring for 33 laboratories in the country. This program received 2 invented patents and 20 utility model patents, and thus has greatly improved the groundwater pollution survey technology of China.

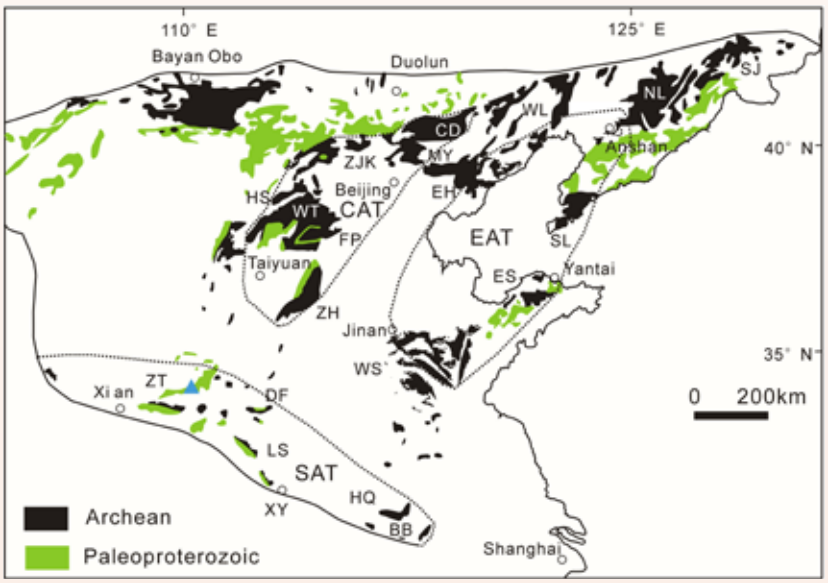
A block diagram of groundwater pollution investigation and assessment technology



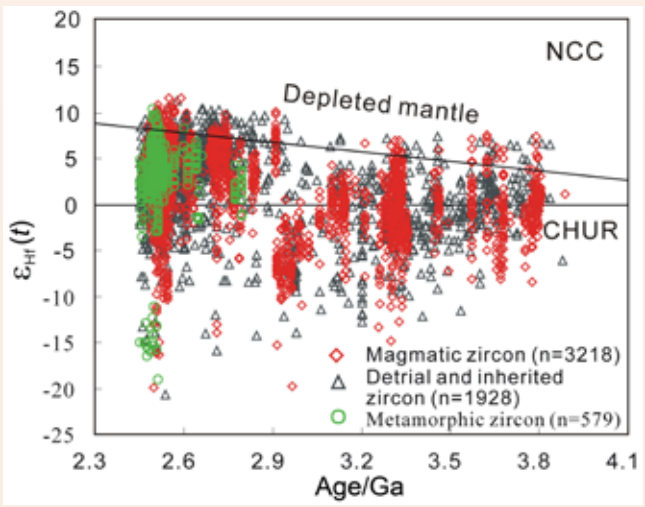
Independently developed sampling device with accessories

3 Crustal structure and evolution of the ancient North China Craton

Prof. Wan Yusheng and his group carried out integrated geological, geochronological and geochemical studies in typical early Precambrian areas of the North China craton, discovering an amount of detrital zircons of 3.4~3.8 Ga in metasedimentary rocks from eastern Hebei, identifying multiple and complex phases of igneous activity ranging from 3.8 to 3.0 Ga in Anshan, and revealing that the Ordos basement was involved in a widespread late Paleoproterozoic tectono-thermal event. They synthesized the general geological records of the Archean basement, and defined and outlined three ancient terranes containing abundant 3.8~2.6 Ga rocks in the North China craton for the first time. These studies, published in international journals such as *Precambrian Research, Gondwana Research, Chemical Geology and American Journal of Science*, have greatly deepened the understanding of early crustal evolution, crust-mantle interaction and banded iron formation of the North China craton.



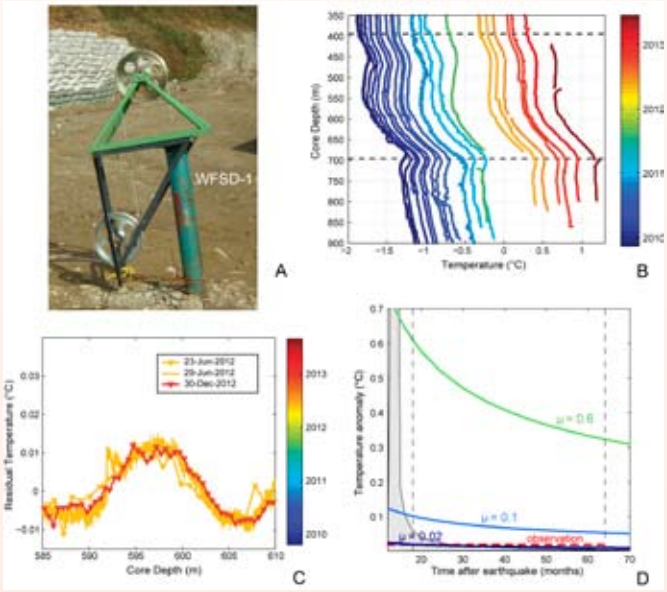
Distribution of early Archean ancient (>2.6 Ga) terranes in the North China craton(EAT: Eastern Ancient Terrane; SAT: Southern Ancient Terrane; CAT: Central Ancient Terrane)



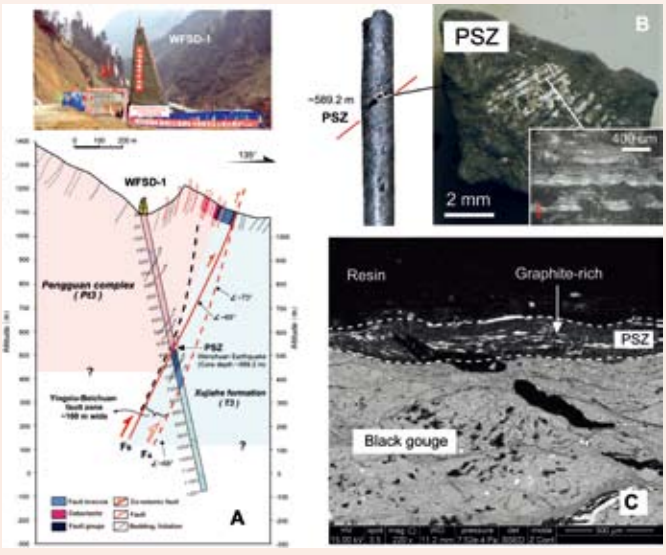
Hf-isotope age of zircons from Archean rocks of the North China craton

4 Significant Achievement of the Research on the Wenchuan Earthquake Fault

Under the joint founding of the Ministry of Science and Technology project, the National Natural Science Foundation project, and the Geological Survey project, research fellow Li Haibing and his research team from the Institute of Geology, CAGS, together with the Institute of Geomechanics, CAGS and other research units, carried out detailed study on the characteristics and structure of the Wenchuan earthquake rupture zone, and rupture process, fault weakening and strengthening mechanisms during large earthquakes. The results revealed the seismic fault, creep fault and deformation mechanisms in the Longmenshan fault belt. Graphite layers were observed and their relationship with the earthquake was clarified; the lowest fault friction coefficient was measured, and for the first time, the signals showing quick fault healing after earthquake were recorded. These results have important significance for improving the seismic faulting theory and for better understanding the Wenchuan earthquake fault mechanisms. The main achievements are published in *Science, Geology, Tectonophysics* and other famous international journals, which have given rise to important academic influence.



Secular temperature measurement based on the Wenchuan scientific drilling WFSD-1



Features of the principal slip zone shown on the core of the Wenchuan scientific drilling WFSD-1

Chapter VII Key Laboratories and Scientific and Technological Research Platforms

Key laboratories and scientific and technological research platforms play a critical role in science and technology innovation of the CAGS. These labs and platforms are major vehicles for building and developing research disciplines and also important grounds to attract, train and support exceptionally talented and innovative professionals in science and technology.

By the end of 2014, there were 2 international and 4 national scientific and technological platforms at the CAGS, 14 key laboratories affiliated to the MLR, 5 key laboratories to the CGS, and 9 under the CAGS. In addition, there were 5 popular science bases and 4 ministerial testing centers of the MLR, 11 professional centers under the CGS, 15 field observatories set up by the MLR, and the Experimental Base for Geological Projects of the CAGS (under construction).

In 2014, all the laboratories and science and technological platforms made substantial scientific and research achievements, organized varieties of academic exchanges. Numerous scientific professionals were trained and the scientific and research level of the Academy was significantly improved, which has strengthened the scientific and technological innovation capacity of the Academy.

International platforms

Ser. No.	Laboratory Name	Supporting Institution	Director
1	The International Research Center on karst under the Auspices of UNESCO	The Institute of Karst Geology, CAGS	Jiang Yuchi
2	The International Centre on Global-scale Geochemistry under the Auspices of UNESCO	Institute of Geophysical and Geochemical Exploration, CAGS	Han Ziye

National platforms

Ser. No.	Laboratory Name	Supporting Institution	Director
1	State Key Laboratory of Continental Tectonics and Dynamics	Institute of Geology, CAGS	Xu Zhiqin

Continued

Ser. No.	Laboratory Name	Supporting Institution	Director
2	The Beijing SHRIMP Center	Institute of Geology, CAGS	Liu Dunyi
3	National Center for Geological Exploration Technology	Institute of Geophysical and Geochemical Exploration, CAGS	Han Ziye
4	National Center For International Research on Karst dynamic system and Global change	Institute of Karst Geology, CAGS	Jiang Yuchi

MLR Key Laboratories

Ser. No.	Name	Supporting Institution	Director
1	MLR Key Laboratory of Continental Dynamics	Institute of Geology, CAGS	Xu Zhiqin
2	MLR Key Laboratory of Isotope Geology		Zhu Xiangkun
3	MLR Key Laboratory of Stratigraphy and Paleontology		Ji Shu'an
4	MLR Key Laboratory of Earthprobe and Geodynamics		Gao Rui
5	MLR Key Laboratory of Metallogeny and Mineral Resource Assessment	Institute of Mineral Resources, CAGS	Mao Jingwen
6	MLR Key Laboratory of Salt Lake Resources and Environment		Zheng Mianping
7	MLR Key Laboratory of Neotectonic Movement and Geohazard	Institute of Geomechanics, CAGS	Wu Shuren
8	MLR Key Laboratory of Paleomagnetism and Paleostructure Reconstruction		Yang Zhengyu
9	MLR Key Laboratory of Eco-geochemistry	National Research Center for GeoAnalysis	Zhuang Yuxun
10	MLR Key Laboratory of Groundwater Science and Engineering	Institute of Hydrogeology and Environmental Geology, CAGS	Chen Zongyu
11	MLR Key Laboratory Geochemical Survey Technology	Institute of Geophysical and Geochemical Exploration, CAGS	Wang Xueqiu
12	MLR Key Laboratory of Geophysical Electromagnetic Exploration Technology		Fang Hui
13	MLR Key Laboratory of Karst Ecosystem and treatment of Rocky	The Institute of Karst Geology, CAGS	Jiang Zhongcheng
14	MLR Key Laboratory of Karst Dynamics		Yuan Daoxian

CGS Key Laboratories

Ser. No.	Laboratory Name	Supporting Institution	Director
1	Key Laboratory of In-situ Stress Measurement and Monitoring, CGS	Institute of Geomechanics, CAGS	Chen Qunce
2	Key Laboratory of Groundwater Remediation, CGS	Institute of Hydrogeology and Environmental Geology, CAGS	Han Zhantao
3	Key Laboratory for Element Microzone and Morphological Analysis, CGS	National Research Center for GeoAnalysis	Zhan Xiuchun
4	Key Laboratory of Geochemical Cycling of Carbon and Mercury in the Earth's Critical Zone, CGS	Institute of Geophysical and Geochemical Exploration, CAGS	Cheng Hangxin
5	Key Laboratory of Karst Collapse Prevention, CGS	The Institute of Karst Geology, CAGS	Lei Mingtang

CAGS Key Laboratories

Ser. No.	Laboratory Name	Supporting Institution	Director
1	Key Laboratory of In-situ Stress Measurement and Monitoring, CAGS	Institute of Geomechanics, CAGS	Chen Qunce
2	Key Laboratory of Shale Oil and Gas Geological Survey, CAGS		Wang Zongxiu
3	Key Laboratory of Re-Os Isotope Geochemistry, CAGS	National Research Center for GeoAnalysis	Qu Wenjun
4	Key Laboratory for Element Microzone and Morphological Analysis, CAGS		Zhan Xiuchun
5	Key Laboratory of Groundwater Remediation, CA GS	Institute of Hydrogeology and Environmental Geology, CAGS	Han Zhantao
6	Key Laboratory of Quaternary Chronology and Environment Evolution, CAGS		Zhao Hua
7	Key Laboratory of Geochemical Cycling of Carbon and Mercury in the Earth's Critical Zone, CAGS	Institute of Geophysical and Geochemical Exploration, CAGS	Cheng Hangxin
8	Key Laboratory of Karst Collapse Prevention, CAGS	The Institute of Karst Geology, CAGS	Lei Mingtang
9	Key Laboratory of 3D Exploration for Ore District, GAGS & HFUT	Institute of Mineral Resources, CAGS; Hefei University of Technology	Lü Qingtian

CGS Professional Centers

Ser. No.	Laboratory Name	Supporting Institution
1	The National Geological Mapping Research Center	Institute of Geology, CAGS
2	Center for Stratigraphy and Paleontology, CGS	
3	Three-dimensional Geological Survey and Research Center, CGS	
4	Research Center of Continental Dynamics, CGS	
5	Geological Research Center on Global Climate Change, CGS	Institute of Karst Geology, CAGS
6	Research Center on Metallogenic Regularity and prognosis of Mineral Resources, CGS	Institute of Mineral Resources, CAGS
7	Centre of Deep Exploration, CGS	CAGS (Headquarters)
8	Geothermal Survey and Research Center, CGS	Institute of Hydrogeology and Environmental Geology, CAGS
9	The Research Center on Neotectonic and Crust Stability, CGS	Institute of Geomechanics, CAGS
10	Research Center of Geochemical Survey and Assessment on Land Quality, CGS	Institute of Geophysical and Geochemical Exploration, CAGS
11	Research Center for Geoanalysis Standards, CGS	National Research Center for GeoAnalysis

Popular Science Outreach of MLR

Ser. No.	Name	Supporting Institution	Recommending Organization
1	Karst Geology Museum of China	The Institute of Karst Geology, CAGS	China Geological Survey
2	Li Siguang (J.S.LEE) Memorial Hall	Institute of Geomechanics, CAGS	
3	Groundwater Science and Engineering Experimental Site	Institute of Hydrogeology and Environmental Geology, CAGS	
4	Scientific Observation Station for Potash Research and Resources Utilization of Lop Nor Salt Lake	Institute of Mineral Resources, CAGS	
5	MLR Key Laboratory of Salt Lake Resources and Environment		

Quality Monitoring and Test Centers of MLR

Ser. No.	Name	Monitoring and Test Scope	Undertaken by
1	National Research Center for GeoAnalysis	Nonferrous and ferrous metallic, rare and scattered metallic, noble metallic, nonmetallic ores, energy mineral resources and products; ecological and geochemical environment, groundwater, mineral water, sea water	National Research Center for GeoAnalysis
2	Supervision and Analysis Center for Groundwater Mineral water and Environment, MLR	Groundwater, surface water, mineral water and products, hydrogeochemical environment, mining geo-environment and agricultural geologic environment; Quaternary geological environment, engineering geology and environment	Institute of Hydrogeology and Environmental Geology, CAGS
3	Control and Supervision Center of Geochemical Exploration, MLR	Iron ore, manganese ore, chromite, copper ore, lead ore, zinc ore, polymetallic ore, vanadium titano-magnetite, etc.	Institute of Geophysical and Geochemical Exploration, CAGS
4	Supervision and Testing Centre for Karst Geology and Resources, MLR	Karst geology, ecological and geochemical environment, mining geo-environment and agricultural geologic environment, karst groundwater, mineral water, metal and nonmetals, physical properties of rock and soil test	Institute of Karst Geology, CAGS

1 National Scientific Research Platforms

(1) State Key Laboratory of Continental Tectonics and Dynamics (MLR Key Laboratory for Continental Dynamics)

Guided by the continental dynamic theory and equipped with advanced high-tech tools, the laboratory is dedicated to solving key scientific issues on the continent of China, conducting multidisciplinary frontier and basic researches, leading basic geological investigation and addressing the demands for resources/energy/disaster prevention of the country.

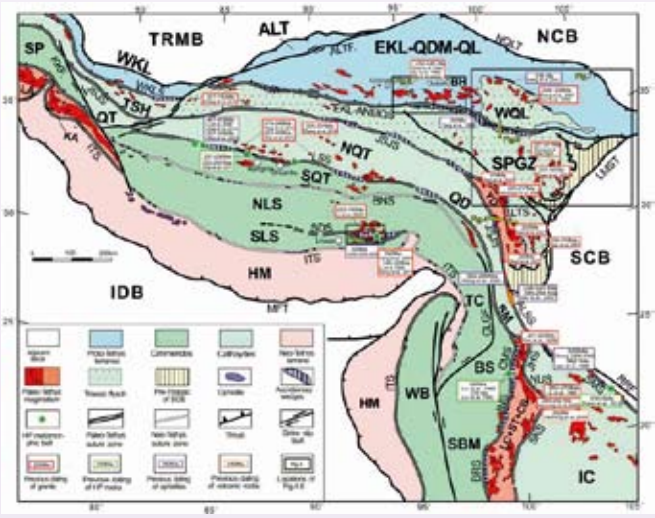
After two years' construction, the laboratory was accepted by the Ministry of Science and Technology as the first national key laboratory of the Ministry of Land and resources on April 9, 2014.

Acceptance check for the national key laboratories by the expert group from the MST on 9 April, 2014

In 2014, the laboratory edited 3 international monographs (*Tectonophysics, Gondwana Research and Journal of Asian Earth Science*), and published 109 papers in SCI-indexed journals, 76 papers in overseas SCI-indexed journals, 36 in the core journals of China and 4 EI-papers.

The Laboratory of Microzone Material Structure and Fabrics under the State Key Laboratory of Continental Tectonics and Dynamics has also made significant progress, including the establishment of 4 field bases. A series academic activities including international cooperation and exchanges, the International Workshop on Ophiolite, Mantle Process and Related Ore Deposits, and an initiative for establishing the Mantle Research Center have been very influential in the global geological communities. The laboratory carried out a project supported by the national scientific fund for outstanding youth and 4 projects supported by the National Natural Science Foundation of China. As a coordinator, the laboratory implemented the integrated China Continent Scientific Drilling Program, completed 13 drill holes in Wenchuan and Yarlung Zangbo and 4 great deep seismic reflection profiles for the SinoProbe Program, in addition to other research and survey projects regarding the Qinghai-Tibet Plateau, Central Orogenic Belt, crust probing, of which 10 projects were assessed as excellent results.

Innovative results were obtained in such projects as continental dynamic study, structural framework of the Central Orogenic Belt. Diamond and other ultrapressue mineral inclusions characterized by crust-derived isotopes were discovered in podiform chromite in ophiolite of Tibet, which would open a new field for the study of ophiolite and pyrolite evolution. The evidence of crustal material recycling experienced by ophiolite and peridotite, which entered the mantle due to subduction, presented a very challenging opportunity for the global geological communities. Research of the laboratory concluded that the Qilian-Altun orogen underwent the early Paleozoic multi-stage metamorphism related to collision and orogeny, and proposed the orogenic type and process of the Indosinian collision-orogenic system in the Tibet Plateau and argued that the Paleo-Tethyan system in the Qinghai-Tibet Plateau is the product of amalgamation of the east Cimmersides and west Cathaysides.



Paleo-Tethyan Structural framework in the Qinghai-Tibet Plateau

International Workshop on Ophiolite, Mantle Process and Related Ore deposits

(2) The Beijing SHRIMP Centre (National Science and Technology Infrastructure)

The Beijing SHRIMP Centre is one of the National Science and Technology Infrastructures, jointly recognized by the Ministry of Science and Technology and the Ministry of Finance. It is incorporated into the Institute of Geology, CAGS in Beijing. The major objectives of the Centre are to provide high-quality geochronological and cosmochronological data; develop new techniques for SHRIMP dating and mineral geochemistry; undertake research in Precambrian geochronology and crustal evolution and the composition (especially the studies of the formation and early history of the solar system and the earth), evolution of the Phanerozoic orogenic belts in Central and Eastern Asia, the geological timescale and the age of large and special mineral deposition. Furthermore, the development of new scientific instruments is also an important objective of the Centre.

In 2014, there were 158 papers in scientific journals (including 84 in international SCI journals) resulting from data produced on the first SHRIMP II of the Centre. It keeps the record as the most productive machine among the similar instruments in the world.

Seminar on the study of crustal evolution by means of geochemistry and isotopic analysis

Field geological investigation in western Shandong

A report published by the National Science and Technology Infrastructure Center, the Ministry of Science and Technology in August of 2014 revealed that the overall satisfaction of the Beijing SHRIMP Center in 2013 ranked first among 21 national science and technology infrastructures.

A special-funded program on national key scientific Instruments and equipment development — "New models of TOF-SIMS for Isotope Geology", which is undertaken by the Beijing SHRIMP Centre, made significant progress in 2014. The machining of all components of the TOF-SIMS has been completed and the project team started assemblage and testing of the complete machine since October 2014.

Two TOF-SIMS developed by the technical team of the Centre (assemblage was completed and testing is in progress)

The CGS held a meeting on the construction of key laboratories in the Beijing SHRIMP Center on March 20th, 2014. Mr. Wang Min, Vice Minister, member of the Leading Party Group of the MLR, Director of the CGS, made an important speech on the meeting.

(3) National Center for Geological Exploration Technology

Supported by the Institute of Geophysical and Geochemical Exploration, CAGS, this research center started operating in April, 1998. It mainly covers the following research areas: mineral exploration, exploration of oil and gas, as well as special energies, investigation and assessment of environmental ecological geochemistry, geothermal exploration, investigation and evaluation of geological hazards, development of standard geochemical materials, geoanalysis and testing technology, research and development of instrument and equipment, improvement of techniques and methods and their popularization and application.

(4) National Center for International Research on Karst Dynamic System and Global Change

This is a State-level international research center, which is supported by the Institute of Karst Geology, CAGS and the International Research Center on Karst under the UNESCO. It was approved by the MST in 2013. Through international cooperation, this research center is able to share the latest information and research results in the world through their access to international science and technical resources. The researchers strive hard to make innovative results in the following topics: evolution regularity of karst dynamic system and influence of karst process on global carbon circulation and carbon sink effect, high-precision stalagmite paleoclimate records, management of karst water-bearing beds of extreme climate events and the response of fragile kart ecological system to global change, especially countermeasures to such problems as resources and environment in karst regions of the developing countries.

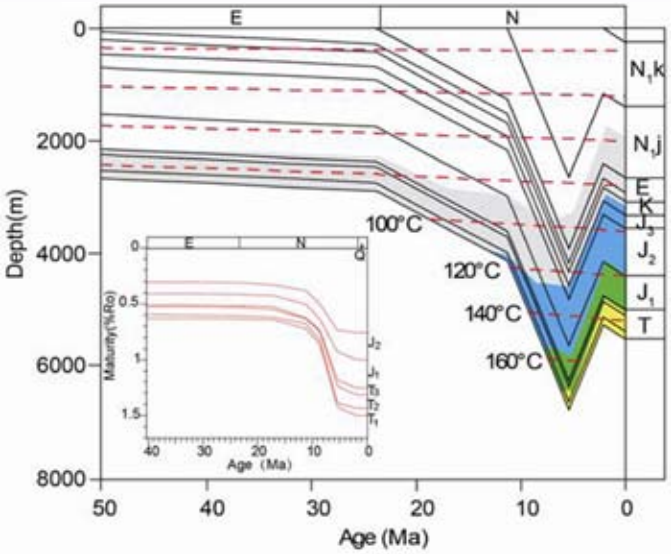
2 Key Laboratories Affiliated to the MLR

(1) MLR Key Laboratory of Isotope Geology

The MLR Key Laboratory of Isotope Geology adheres to the following research directions: deep continental scientific drilling (dynamics of plate convergence boundaries and modern crustal process), huge ultrahigh-pressure metamorphic belts and N-S-convergence of continental plates, terrain amalgamation and collision dynamics of the Qinghai-Tibet Plateau.

In 2014, the lab undertook 4 research projects and completed one special national infrastructural project, published 8 scientific papers with the lab as the first author (2 papers in overseas SCI-index journals, 3 in Chinese SIC-index journals and 3 in the core periodicals of China).

Research of the oceanic ridge subduction process of the Late Carboniferous in the West Junggar area identified a special association of rock dikes (320~290 Ma), which, along with other associations of rock dikes of the same period, indicates an extensional and heat environment of this period, and that this rock association is in agreement with the magmatic rock association formed in an oceanic-ridge subduction environment in the Cenozoic Circum-Pacific subduction zone. The above two magmatic rock associations occurring simultaneously in the Late Carboniferous in the western Junggar area resulted from oceanic ridge subduction. The project also revealed that oceanic ridge subduction might have made a significant contribution to crustal growth and copper and gold mineralizations in the western Junggar area and even the Central Asia orogen. The related research result was released in Gondwana Research.



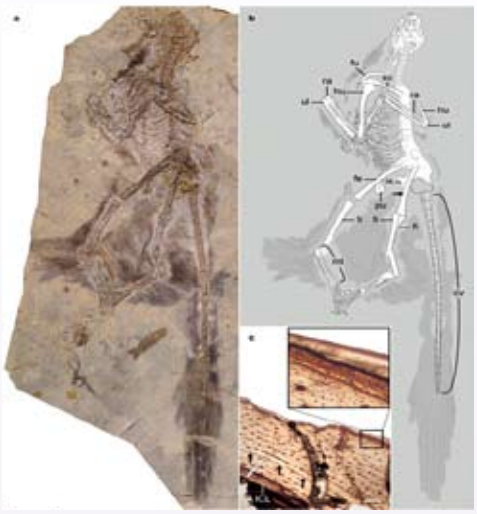
Evolution of the geothermal history and hydrocarbon formation of the Kuqa Basin (Well Yinan II)

(2) MLR Key Laboratory of Stratigraphy and Paleontology

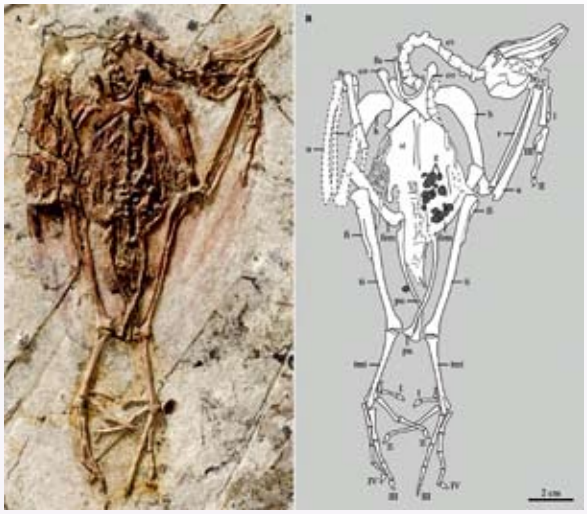
This key laboratory is supported by the Institute of Geology, CAGS and addresses the following major research tasks: basing the lab on the frontier of earth sciences and the demands of social development, developing important basic theories on stratigraphy and paleontology, solving crucial stratigraphic and paleontologic problems in land and resources investigation, developing new and improving existing technical and method systems, conducting research covering early life evolution, biologic and geological environment changes, and dating and correlation of major strata.

In 2014, the lab undertook one project of the CGS, "A survey on the evolution of the national important regional stratigraphic system and the key biological group". 3 projects were initiated in 2014. 5 projects were funded by the National Natural Science Foundation of China. 2 monographs and 28 academic papers were published. The lab invited a foreign expert to present an academic report and sent researchers to attend 2 international symposiums. About 30 researchers attended international or national academic conferences held in China and gave about 20 scientific reports.

The research achievements include newly-found specimens of *Ankylosaurus Kazuoensis* and specimens of *Dromaeosaur Jianchangensis*; dragon fossils discovered in the Yixian Formation in Jianchang, West Liaoning Province; a new species of Neomithes – *Poff Gansus* in the Jehol Biota, providing important information for the study of differentiation of Mesozoic avifauna; discoidal carbonaceous *Kullingia*-like macrofossil found for the first time in Tongren, Guizhou Province, which can be comparable with those appearing extensively in the Ediacaran in other countries, which is of great significance to newly defining its biological attributes and to stratigraphic correlation; the Upper Jurassic bitumen veins-bearing stratum of reef flat facies found on the eastern margin of the Cuoqin Basin around Baoji Village of Baingoin County, Tibet is another significant discovery following the Upper Permian and Triassic



Dromaeosaur Jianchangensis



Neomithes – *Poff Gansus*

marine strata, thus greatly raising the value and position of the Cuoqin Basin for oil and gas exploration.

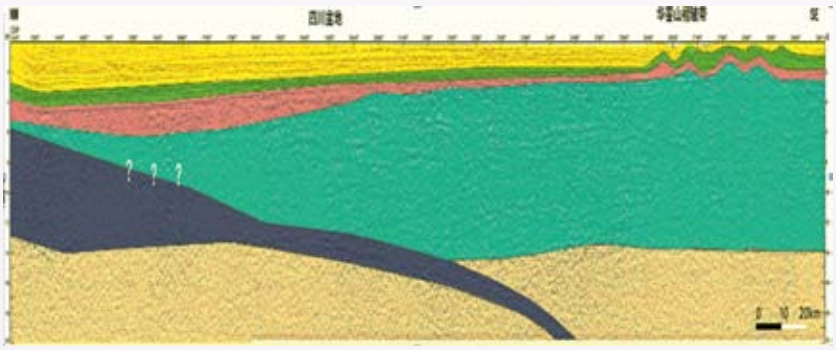
(3) MLR Key Laboratory of Earthprobe and Geodynamics

The laboratory focuses its research work on the development of deep probing techniques, detection of the earth's deep structure and geodynamics, so as to provide scientific support to resources prospecting, prevention and control of disasters and innovation of geoscience theories. It is distinctive and superior that the laboratory applies integrated deep probing technology to explore fine and detailed deep structure of important structural elements and metallogenic areas and built 3-D models delineating the structure and dynamics of the earth from the surface down to the mantle.

In 2014, the lab carried 26 research projects, published 23 SCI-indexed papers (9 in overseas journals and 4 in Chinese journals), and 10 papers in China's core journals. One researcher was sent abroad as a visiting scholar. Other academic activities of the lab include attending international symposiums; inviting and receiving foreign experts; initiating 8 open projects; coming back of postdoc Guo Xiaoyu, trained jointly by related Chinese and American institutions; inviting Prof. Zhuwei Jiang, senior geologist from an Australian mining corporation, Mckay Brooke Resources, as guest research fellow and senior visiting scholar; editing and releasing a video and 5 popular science readings about deep probing techniques and research results.

Project "Deep Seismic Reflection Exploration Experiment and Research on Crustal Structure" for the first time identified fine structure of the extremely thick crust in the Qinghai-Tibet Plateau and a continuous deep reflection Moho, which places a new constraint for geodynamic research of the plateau; established a geodynamic model describing lateral-compression and high-angle-obduction deformation of the crustal blocks on the eastern margin of the Qinghai-Tibet Plateau; revealed ancient subduction

structure beneath the Sichuan Basin, which provided a significant evidence for reviewing the formation of the Yangtze craton and reconstructing the complex structural frame of the South China continent; found that the Songliao Basin lies at the convergence center of two plates, so that it is considered that formation of the Songliao Basin was affected by the convergence of the Mongol-Okhotsk Ocean and Pacific Ocean plates.



Ancient subduction structure beneath the Sichuan Basin discovered with deep seismic reflection

Popular science reading about deep seismic reflection

(4) MLR Key Laboratory of Metallogeny and Mineral Resource Assessment

Centering around country's goals and economic and social demands, the lab is dedicated to the following research fields: ore-forming process and background, metallogenic theories; regional metallogenic patterns and theories, assessment and regionalization of potential mineral resources; important problems and new techniques and methods for the investigation and assessment of mineral resources; and typical cases in the exploration of large-scale ore deposits; strategic research of mineral resources, which is a new research direction of the lab.

The lab was recommended to apply for a national key laboratory. The lab organized the 14th Quadrennial Symposium of International Association on the Genesis of Ore Deposits and the 12th National Conference of Mineral Deposit of China, 69 SCI-indexed scientific papers were published in 2014, including 40 papers in overseas SCI-indexed journals, and 116 papers were published in China's core journals. The lab published 7 monographs and received 3 national invention patents, 1 second prize of the Science and Technology Award of the MLR and 1 first prize of the Science and Technology Award of the National Gold Association. 2 projects were chosen as those among the 2014 Top 10 Scientific and Technological Advances of the CGS and CAGS.

Based on theoretical innovation, researchers of the lab work in cooperation with geological and

exploration institutions and mining corporations and strive to make breakthroughs in mineral prospecting. They have predicted and discovered a number of large or super-large ore deposits, such as the super-large lithium deposit in the surroundings of the Gyabjeka Mine in Sichuan Province with proved reserves of 600,000 Tons, a large Cu-rich orebody beneath an overthrust fault around the Gyama Mine in Tibet, and a large concealed Cu-Fe-Au deposit in the Qiongheba area of eastern Junggar in Xinjiang.

the 12th National Conference of Mineral Deposit of China

(5) MLR Key Laboratory of Salt Lake Resources and Environment

The main research directions of the lab are mineralogenic regularities of salt deposits, theoretical and methodological study of assessment and multiple utilization of salt resources, salt lake environment and global change, geological ecology, biological resources and biologic technology of salt lakes.

In 2014, The lab undertook 22 research projects, published 44 research papers, including 9 SCI(EI)-indexed papers and 1 monograph. The lab presented 22 papers to academic symposiums and 1 project received the National Invention Patent.

Project ”Great progress leading to future breakthroughs in potash exploration in China” was listed in the Top 10 Geological Scientific and Technological Advances in China Geological Survey. The lab organized the 12th International Conference on Salt Lake Research, which took “Future salt lakes—global sustainable research and development” as the theme to discuss such issues as global change and salt lake records, salt lake ecology and biological resources, salt geology and resources exploration, and

chemical engineering of salt. The conference also put forward advises and proposals in regard to future research of salt lakes, multipurpose utilization and protection of resources.

The 12th International Conference on Salt Lake Research

Certificate of the Top 10 Geological Scientific and Technological Advances

(6) MLR Key Laboratory of Neotectonic Movement and Geohazard

The laboratory focuses on the following researches: neotectonics and mobile faults; seismic geology, engineering geological effect of mobile faults, formation mechanisms and hazard formation models of catastrophic geological hazards; theories and methods for prediction and evaluation of sever geological hazards and establishment of technical exchange platforms and research bases of active structure and mitigation and prevention of geological hazards, so as to propose policy-making bases and technical support to the strategy of the country for fighting and alleviating natural disasters.

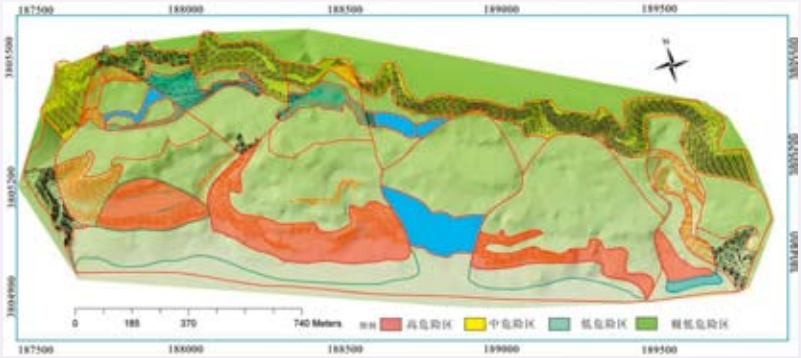
The lab has established a hazard formation model of neotectonics – tectonic landform – mobile fault – seismic geology – present structural stress field – regional crustal stability – severe geohazard and a platform for risk-control research.

In 2014, the lab carried out 1 engineering project and 3 research programs of the CGS; undertook 60 and started 8 projects supported by the National Nature Science Foundation of China; received 1 first prize of the Science and Technology Award of the MLR. The lab sent 56 scientists to attend international symposiums or conferences and 3 groups of 6 researchers to go abroad for international exchanges. 7 academic salons were organized and invited 3 groups of 38 foreign experts to visit the lab. In 2014, 82 research papers were published, including 22 papers indexed by SCI, 11 indexed by EI, and 29 in China's core journals. Three monographs were published. The lab received 4 invention patents of China.

The lab carried out the 1000 m-deep drill stress measurement in Drill Xike-1 of the Shidao Island in the Sansha Area, which is the first deep drill stress measurement in offshore waters in China; developed

the rapid assessment method for engineering landslide disasters and the early warning index system for debris flows in seismic disturbance areas.

1000 m deep drill Xike-1 stress measurement



A Sketch showing the landslide activity and disaster assessment in the Caijiapo engineering disturbance area

(7) MLR Key Laboratory of Paleomagnetism and Paleostructure Reconstruction

This is the first laboratory dedicated to paleomagnetic measurement and research in China, which was established in 1963 under the guidance of late prof. Li Siguang. Carrying on and innovating Prof. Li Siguang's geomechanic theory, the lab has combined geomechanic theory and paleomagnetism method with field geology, geophysics, geochemical and other relevant sciences to deepen basic research on various geological problems such as reconstruction of paleotectonics, restoration of paleoenvironment and magnetic dating for typical strata. One of the major research results of the laboratory is the new understanding of the attribute of the Pre-Mesozoic tectonics of the Alxa block. Based on detrital zircon U-Pb dating, Hf isotopic analysis and paleomagnetic research, for the Middle and Late Devonian-Early and Middle Tertiary sedimentary strata of the Alxa block in the Hexi Corridor region, it is concluded that the Alxa block might not be a component of the North China block in the late Paleozoic. This fresh idea proposed a challenge to the traditional understanding about the tectonic frame of the North China block.

Annual meeting

Field work

(8) MLR Laboratory of Eco-geochemistry

The laboratory adheres to the following objectives: applying ecological geochemical theory to address the growing demands of ecological geochemical studies due to rapid national social economic development and recruiting and retaining exceptionally talented professionals to sustain scientific research and development in ecological geochemistry. Researchers of the lab are dedicated to making the lab an ecological geochemical laboratory among the first-class ones in China and a renowned one in the world.

25 papers were been published, including 7 papers in SCI/EI-indexed journals, and 1 patent has been approved in 2014.

The lab achieved the following major progress:

(a) Geochemical engineering technology for the treatment of acid mine drainage in the demonstration projects

Innovation has been carried out in many key science problems, such as material development and process flow and remediation mechanism. It is a model for heavy metal pollution control and prevention of acid mine drainage by geochemical engineering technology and a new try of technology research for acid mine drainage source control.

(b) Study on the ecological geochemical behavior of organic pollutants

The research results show that the monsoon circulation plays an important role in POPs long-distance migration in high altitude areas in China. Using cosmogenic nuclide 7Be as a reference of the atmospheric circulation, the atmospheric circulation is considered an important influence factor to POPs latitude distribution in the East Asia monsoon region.

(c) Organic analysis technology

A methodology system was completed for analyzing the main organic pollutants in underground water. Analysis methods were developed for 94 categories of pesticides and 42 types of semi-volatile organic pollutants.

A demonstration project of acid mine waste water control by using geochemical engineering technology. The water can be used for fish farming after treatment.

(9) MLR Key Laboratory of Groundwater Science and Engineering

The MLR Key Laboratory of Groundwater Sciences and Engineering is dedicated to addressing country's pressing needs of sustainable utilization of groundwater through conducting the cutting-edge basic research and innovations with respect to circular evolution and sustainability of groundwater. The lab also boosts domestic and international cooperation and fosters an environment favorable to innovative talents and provides strong scientific and technical support to safe utilization of regional groundwater and solving problems related to land resources and environment.

In 2014 the lab undertook 22 project and sent 10 researchers to attend international academic conferences or technical training courses, invited renowned Chinese and overseas scholars for international cooperation and academic exchanges.

The project of "Evolution Mechanism and Control of Groundwater in the North China Plain", which is the first national key basic research program (973 Program) in the field of groundwater research, passed acceptance arranged by the MST. The project reconstructed the evolution characteristics of

the hydrodynamic field in the North China Plain during the past 60 years, defined critical identifying indicators of groundwater crisis, and proposed control measures for easing crisis of groundwater in the North China Plain, thus significantly raising the overall level of advancement in the research on groundwater in large basins of China. The Project of "Study of Mechanisms for the Influence of Structural Variations of Aquifers Driven by Group Coal Mining on Regional Water Circulation" analyzed the development of mining-induced fractures and structural variation regularity of aquifers, and set up a digital model for the structural variation of aquifer space in typical mining districts and created a concept of "elliptic parabolic concave" for the jump curve surface of permeability in goafs.

Researcher Chen Zongyu attending the IAEA-CRP work conference (Vienna, Austria)

Discussion on the conclusion of Project "Evolution Mechanism and Control of Groundwater in the North China Plain" (Shijiazhuang, Hebei Province)

(10) MLR Key Laboratory of Geochemical Survey Technology

The laboratory aims at international scientific frontier and takes into account important scientific problems in economic and social development to undertake the following tasks: carrying out innovative, basic and public-oriented research for geochemical exploration; retaining and improving innovative talents and trying to establish a world-leading research base of geochemical survey technology; conducting geochemical survey and research of global geochemical baselines and geochemical mapping technique; developing deep-penetrating geochemical survey theory and technology, so as to provide technical support to mineral prospecting in overburden areas and deep strata.

On April 9, 2014 the laboratory held the first meeting of the Academic Committee. The lab has actively promoted the initiation and implementation of the project "Global multi-scale geochemical mapping" to serve the "One Belt One Road" strategy of the country, which received support from IUGS President Orb Hansley Roland.

Wang Xieqiu, research fellow from the lab, teaching geochemical mapping technique in a training course in Papua New Guinea

IUGS President Orb Hansley Roland visiting the laboratory

(11) MLR Key Laboratory of Geophysical Electromagnetic Exploration Technology

The laboratory focuses on airborne electromagnetic survey, ground electromagnetic survey, downhole electromagnetic survey, geophysical data processing of electromagnetic survey and other basic researches, and provides technical support for undertaking basic, and strategic research of the national geological survey.

Supported by the national 863 Program and the special geological survey project, the time-domain fixed-wing airborne electromagnetic system passed successful test and trial flight; the 2000 m deep well TEM tri-component measurement system was developed with the support of a special public-welfare scientific and technological project. These achievements supplemented new equipment to deep mineral prospecting of the country.

Trial flight of the time-domain fixed-wing airborne electromagnetic system

TEM tri-component measurement system

(12) MLR Key Laboratory of Karst Ecosystem and Treatment of Rocky Desertification

Taking the study of karst ecological system as the core task, the laboratory adheres to the following research directions: to reveal the structure, function and evolution patterns of karst ecosystem; to analyze major ecological problems related to rocky desertification, soil erosion and vegetation degradation in karts regions of China; and to explore key techniques and models of comprehensive control on rocky desertification, water and land conservation, vegetation restoration for fragile karst ecosystems.

In 2014, the lab undertook 33 research projects, published 28 academic papers, including 13 SCI- and EI-index papers; organized the academic committee meeting, conference on exchanges regarding the construction of the third batch of key laboratories, a number of special workshops; sent 8 researchers to attend 6 academic symposiums.

In Project of "comprehensive hydrogeological investigation of the Nandong underground river system", analysis was done for the stability of vegetation and soil aggregates in karst mountainous areas, which indicates that glass land and bush-woods can be chosen as the major vegetation for water and soil conservation in karst mountainous areas; the research of soil erosion and water loss in karst peak-cluster depressions in the Guohua region, Pingguo County in Guangxi shows that water and soil loss varied in different land forms and soil erosion varied when soil is used in different ways.

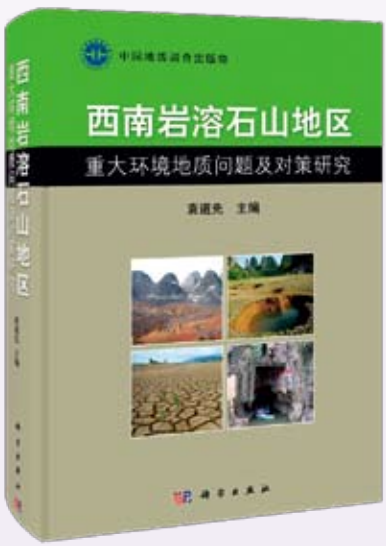
A conference of the lab Academic Committee

(13) MLR Key Laboratory of Karst Dynamics

The Key Laboratory of Karst Dynamic is among the first of key labs set up by MLR in 2004, also the key member of International Research Center on Karst under the Auspices of UNESCO and National Center for International Research of Ministry of Science and Technology.

Based on the IRCK and guided by the systematic geoscience, the lab takes advantage of the geographic features and international influence of China and is dedicated to the following tasks: improving the karst geodynamic theory, establishing a laboratory and experimental platform, training high-rank researchers, making contributions to fulfilling the goals of the lab, conducting researches on the response of karst dynamic system to the global change, so as to provide scientific and technological support for solving ecological and environmental problems and making scientific and technological innovations in land and resources management in karst regions.

In 2014, the lab sent 30 researchers to participate in national and international academic exchanges, made 2 geological surveys abroad for scientific research, organized 1 international and 1 national academic conferences, undertook 50 different type of projects, and published 40 academic papers, including 17 SCI papers, as well as an academic monograph Key Environmental and Geological Issues and Response Options, edited by Academician Yuan Daoxian.



Key environmental and geological issues and response options

Correlative analysis between the stalagmites oxygen isotope and the local monitored data: temperature, precipitation, drought and flood indexes revealed that the stalagmite oxygen isotope with an average resolution of 1.5 years responds to the change characteristics of regional summer monsoon; canonical correspondent analysis of soil heavy metals from tailings proved that heavy metal contamination effects the soil carbon cycle indirectly through the influence to soil microflora.

Abroad Geological Survey: Visiting the Department of Groundwater Resources, Ministry of Natural Resources and Environment of Thailand

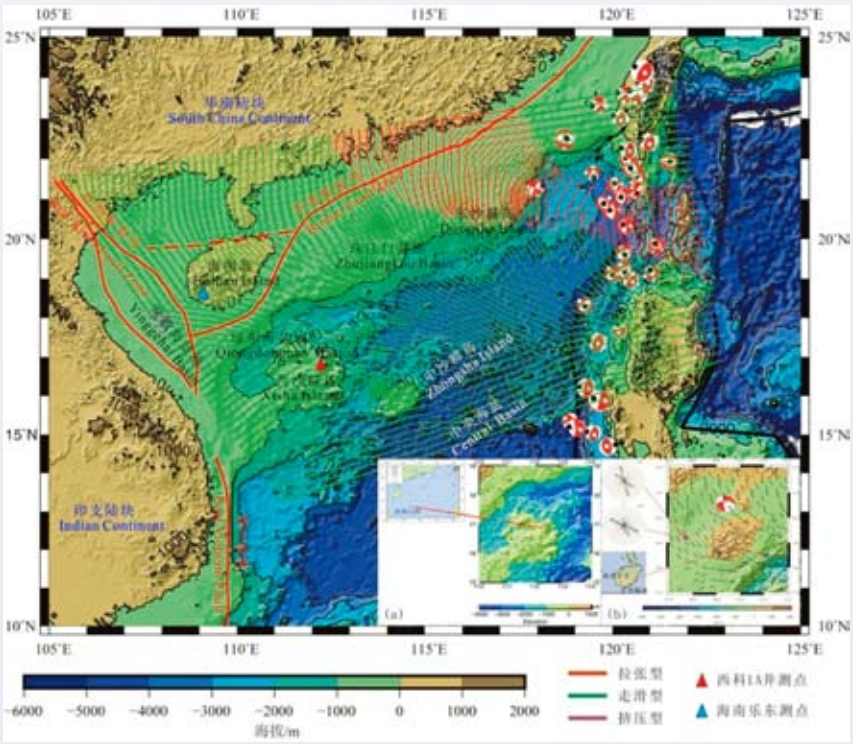
3 Key Laboratories Affiliated to the CGS and CAGS

(1) Key Laboratory of In-situ Stress Measurement and Monitoring, CGS (CAGS)

The laboratory is supported by the Institute of Geomechanics and focuses on the following research directions: developing basic theories, test techniques and methods regarding crustal and structural stress fields, as well as related instruments and equipment; extending applications of crustal stress and lithological mechanics to structural deformation, endodynamic disasters and metallogeny, so as to provide technical support to basic research of geodynamics, exploitation of natural resources, prediction and early warning of geological hazards.

In 2014, the lab undertook 30 various research projects. 14 scientific papers were published with the lab as the first author, including 10 papers published in journals indexed by SCI/EI, received 1 national patent for utility models. The lab organized a meeting of the Academic Committee; invited foreign experts and organized 3 academic symposiums.

The FEM-based numerical simulation analysis was used to obtained the distribution regularity of the present crustal stress field of the northern South China Sea; the lab carried out the "Pilot study on methods and techniques of mapping of special geology and geomorphology"; completed the crust stress measurement and the construction of the experiment base for field calibration monitoring and the platform for laboratory calibration.



Measurement points and crustal stress field (in the direction of maximum horizontal principal stress)

(2) Key Laboratory of Groundwater Remediation, CGS (CAGS)

The laboratory adheres to the research direction of "groundwater pollution mechanism and remediation" and focuses on the following research tasks. In view of the weak basis of China in the control and remediation of groundwater pollution and poor application of related remediation technology, and strong public and market demands, the lab focuses on the development and application of groundwater remediation technology through applications of innovative research and application results from aboard. At present, a research system has been established, with pollutant migration mechanism, geological microbiology and nanotechnology of remediation as the predominant research direction and characterized by integrated development in the research features of soil and groundwater contamination mechanism, contamination remediation methods, field investigation and in-situ remediation technology application, groundwater pollution prevention and regionalization.

After more than two years' development, the lab passed the assessment and acceptance of the CAGS as one of the key laboratories of Hebei Province, and was put into operation. In 2014, the lab undertook 6 research projects, published 22 scientific papers, including 8 indexed by SCI and EI; organized the annual meeting of the Academic Committee, the Academic Seminar on Groundwater Contamination Remediation; carried out international cooperative projects with the University of Newcastle Carl, UK, and participated in the UK-India cooperative project of the British Royal Academy of Engineering "Iron/carbon adsorption material application in environmental remediation"; conducted in-situ remediation study on organic contamination field and established the research base of organic contamination field investigation and remediation.

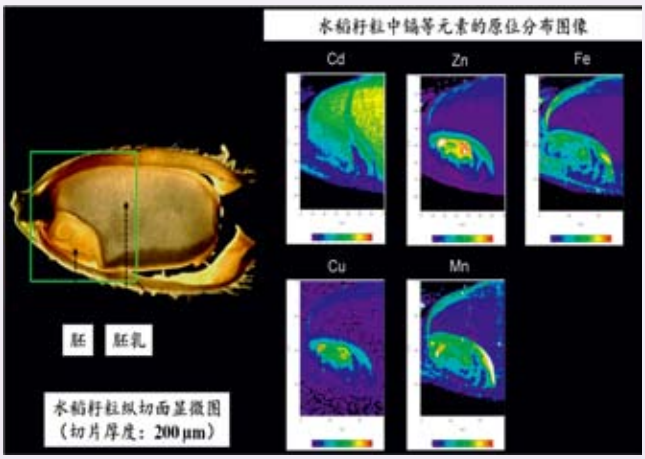
In-situ remediation experiment of organic contamination field

(3) Key Laboratory for Element Microzone and Morphological Analysis, CGS (CAGS)

Based on in-situ micro-analysis and speciation analysis techniques including LA-ICPMS, μ-XRF/μ-SRXRF, LIBS, HPLC/GC-ICPMS, SR-XAFS/XANES, the lab's research activities have been focused on development and application for elemental concentration, distribution of major and trace elements, and also focused on the study of elemental speciation, migration and transformation of samples in typical mining districts based on element morphology, in order to provide technical support for mineral prospecting and multipurpose utilization and ecological research.

In 2014, the lab undertook 25 various projects, published 4 academic papers; invited experts from foreign research institutions such as the MPI of Germany to visit the lab and gave lectures and special academic reports; discussed with Dr. Nigel J. Cook from Adelaide University of Australia on the issues of in-situ microzone analysis.

In 2014, the LA-ICPMS methods for in-situ multi-element micro-analysis of mineral melt inclusions in basalts and REE-enriched carbonate minerals such as bastnaesite have been developed and put into practical application. Phosphates are proved to be effective for extracting water-soluble and botanically active arsenic species in soils, and a matched HPLC/ICPMS arsenic determination method has been established. Evidences were found that $Pb(Ac)_2$ facilitates greatly the absorption of Pb by plants, and Zn can be more toxic to plant seedling, the coordination of Pb^{2+} has a complicated changes in culture fluid and Cd is enriched mainly in endosperm of rice grain.



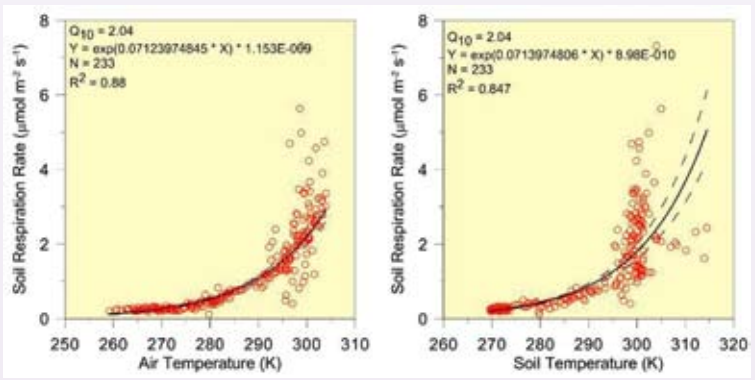
Images showing the distribution of Cd and other elements from rice grains obtained with the μ-SRXRF technique

Dr. Klaus Peter Jochum discusses with researchers of the lab

(4) Key Laboratory of Geochemical Cycling of Carbon and Mercury in the Earth's Critical Zone, CGS (CAGS)

The lab mainly carries out geochemical research and investigation to solve important scientific problems in the economic and social development of China, so as to providing technical support for rational use of land and environmental protection; adheres to the following research directions: geochemical cycling of carbon and global change, geochemical cycling of mercury and carbon-mercury coupling mechanism, and geochemical cycling of other elements and land quality.

The temperature sensitivity of soil respiration (Q_{10}) shows that the soil respiration rate has the same response to atmosphere temperature and soil temperature, both 2.04. The gas-mercury and mercury exchange flux in soil shows a synchronous change, indicating that the gas-mercury content in soil directly influences the exchange flux of mercury, and they have a coupling relation. The lab made a significant breakthrough in the block assignment method in the second land survey throughout China, which has solved the technical problem for direct match of the pattern spots and geological investigation data of the Northeast Plain, North Chin Plain and loess areas of China. Along with the issue of the *Communique of National Survey of Soil Pollution* by the MLR and MIP, the lab provides consultant service about legislation of soil pollution control.



Curves showing temperature sensitivity of soil respiration (Q_{10})

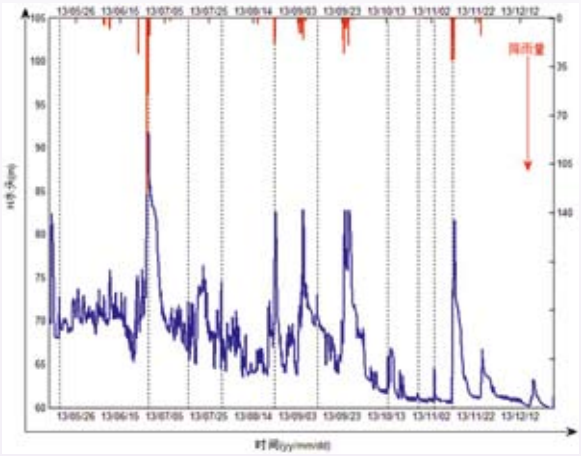
Field work of geochemical investigation of land quality

(5) Key Laboratory of Karst Collapse Prevention, CGS (CAGS)

The research areas of the lab are as follows: investigation and risk assessment of karst collapse, formation process and influence factors of karst collapse, monitoring technique of potential sinkhole, karst collapse prevention and sinkhole remediation.

In 2014, the lab undertook 21 projects and published 6 research papers; established 2 field bases; sent a delegation to attend the IAEG XII Congress; invited research fellows working abroad to return to give lectures and conduct academic exchanges; organized training course on 1:50000 karst collapse investigation techniques and a conference for experience exchange on karst collapse investigation data input system; attended the Annual Symposium of Engineering Geology.

The lab compiled the criterion of 1:50000 karst collapse investigation and monitoring, the criterion of engineering investigation, design and construction for control of karst collapse; established three karst collapse development models for disintegration, corrosion and hydraulic fracture respectively and three experiments were designed corresponding to the three models to obtain the development criteria of karst collapse.



Analysis of monitoring data using the Grubbs detection algorithm

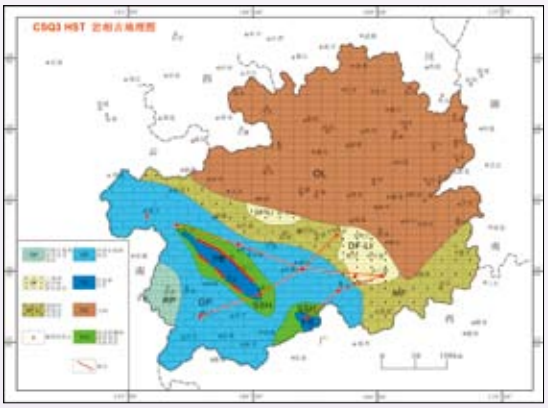
3-D geological sandbox of karst collapse in the Guangzhou Experimental Base

(6) Key Laboratory of Shale Oil and Gas Geological Survey, CAGS

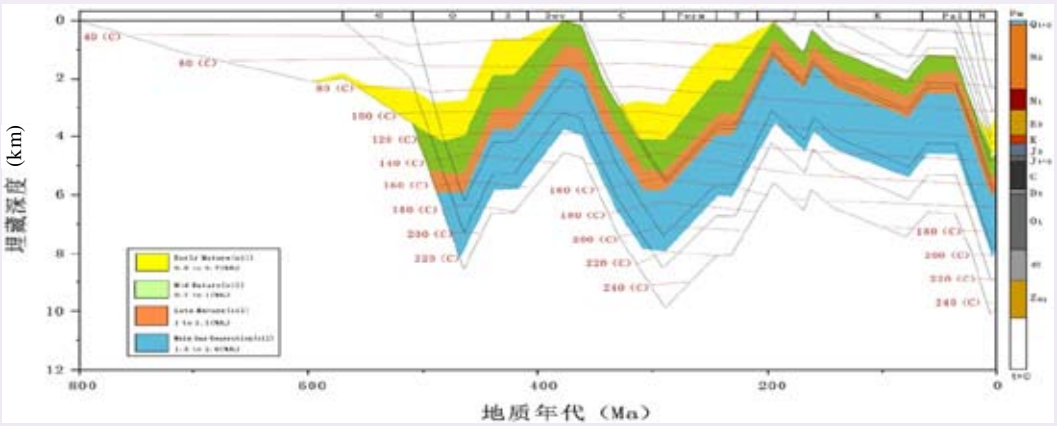
The lab adheres the following research directions: based on the development strategy of China in prospecting for unconventional oil-gas resources and taking shale gas as the stress, applying the geomechanic theory to analyze factors and conditions of shale gas accumulation; applying in-situ stress measurement, hydraulic fracturing, lithological mechanics and micro-seismic network to conduct research of structural deformation and structural evolution, stress field measurement, development and application of lithological mechanics, fracture prediction and reservoir evaluation; research of shale gas accumulation mechanisms and resources evaluation; establishment of the shale gas evaluation system, making efforts to build a scientific research base of investigation and evaluation of shale gas resources with Chinese characteristics.

In 2014, the lab received 1 second prize of the MLR Science and Technology Award and 1 national patent; published 3 monographs, over 20 scientific papers; attended investigation and symposium organized by SINOPEC in a shale gas field in Fuling, Chongqing, International Symposium on Salt Lakes, academic exchanges and investigation in Dalhousie University in Canada, and invited foreign experts to give lectures and academic reports.

The lab carried out correlative analysis for the stratigraphic ages of the different lower Paleozoic structural areas in the Qaidam Basin and adjacent areas; completed the Paleozoic Structural Map and the Lithofacies Paleogeographic Map and analyzed the oil-gas geological conditions of the Paleozoic; conducted researches of sedimentary characteristics and distribution of depocenters and residuals of the shale in the Cambrian Niutitang Formation, Silurian Longmaxi Formation and Carbonaceous Datang Formation.



Lithofacies Paleogeographic map of the qianzhong uplift and surrounding carbonaceous strata



A Map of Paleozoic burial history of the qaidam Basin

(7) Key Laboratory of Re-Os Isotope Geochemistry, CAGS

The lab focuses on developing Re-Os isotope theory, conducting research on key techniques and standard materials, promoting applications and providing a scientific basis for dating of ore-formation epochs and tracing of material origins.

The lab has created a series of Re-Os isotope experiment method for different sample, such as molybdenite, pyrite and arsenopyrite, developed several primary reference materials, and dated hundreds of metallic mineral deposits at home and abroad, which have solved the long-term unsolvable problems of direct dating of deposits; established a series of mass spectrometric methods and data processing procedures suitable to various geological samples; widened the application scope of Re-Os isotopic dating technique with the stress placing on the analysis of geological samples with high content of organic matter; extended the application to crude oil, graphite, bitumen, and organic-rich limestone, which provides isotope chronological constraints on the formation and destruction of oil reservoirs, regional metamorphism, and sedimentary rock diagenesis. The major three research tasks were supported by the National Natural Science Foundation of China.

In early 2015, the laboratory successfully completed its tasks in the construction phase and passed the check and acceptance.

The key lab is being checked and accepted

(8) Key Laboratory of Quaternary Chronology and Environment Evolution, CAGS

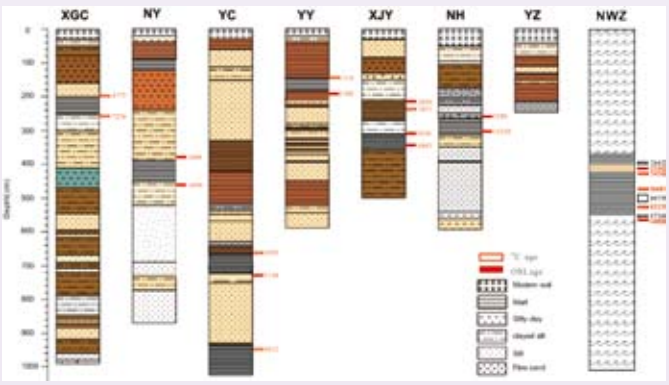
The lab focuses its research on the geological records of climate and environmental evolution since the Quaternary. Aiming at important problems regarding Quaternary chronology and climate-hydrological environment evolution process, the lab conducts research to reveal the time series of paleoclimate and paleoenvironment evolution in different rudimentary environments and at different temporal scales since the Quaternary, especially late Quaternary by improving and developing the Quaternary dating technique and analytic technique of paleoclimatic environmental indexes, so as to forecast future weather and the change tendency of hydrological environment and provide a basis for the study of global changes and rational utilization of regional ground water resources.

In 2014, the lab undertook and participated in 19 projects, published 13 academic papers, including 3 SCI papers, 1 EI paper, 1 monograph; actively carried out academic exchanges, sent researchers to visit foreign research institutions and attended 26 academic conferences in China.

The laboratory successfully completed its tasks in the construction phase and passed the check and acceptance on December 13, 2014.

In Project "Holocene Hydrological Environment Changes in North China Plain with Daluze as a Case", supported by the National Natural Science of China (41372171), the spatial distribution range of ancient Daluze was delineated. By means of establishing a high-precision chronology frame and high-resolution analysis of climate proxies, the Holocene hydrological environmental change history of ancient Daluze is expected to obtain. The preliminary result shows that the most prosperous period of Daluze is the middle Holocene, when the climate was relatively warm and humid.

The 11th National Symposium on the Quaternary Period



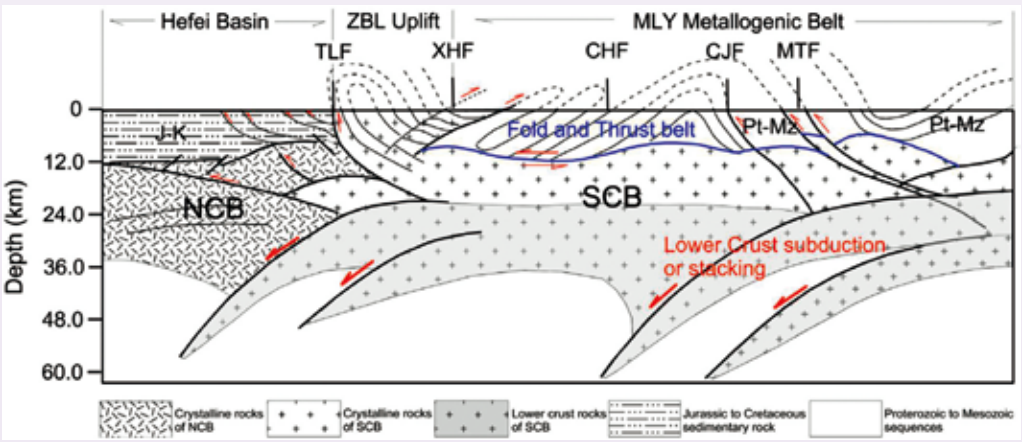
Comparison of lithological characteristics of the sedimentary strata in ancient Daluze

(9) GAGS & HFUT Key Laboratory of 3D Exploration for Ore District

The laboratory focuses on the research areas in exploring geological processes and 3D structures in major ore-forming belts, conducting stereoscopic sounding and establishing 3D models in ore-concentrated areas, and carrying out research on regional metallogenic systems and metallogeny and deep mineral exploration techniques and methods.

In 2014, the lab had 38 employees, 9 guest researchers and 3 introduced researchers; trained 39 doctoral and mater students; undertook and participated in 58 projects; participated in 2 international cooperation projects. The lab won 2 second prizes of provincial and ministerial invention awards, 1 invention patent; published 30 research papers, including 13 SCI papers and 17 in Chinese core periodicals, and 2 monographs. In 2014, the lab organized the meeting of the Academic Committee to discuss the construction plan of the lab, determined the tasks and goals of the lab and suggested to apply for the provincial and ministerial key laboratory as early as possible. The lab organized the Symposium on deep mineral investigation and new techniques, which had over 270 participants.

Breakthroughs and new understanding were made in the study of deep ore-forming background and geodynamic mechanism of the metallogenic areas in the middle and lower valleys of Yangtze River. A “crocodile mouth”-shaped reflective pattern and “ramp-type” structural pattern were identified for the first time beneath the ore-concentrated areas in the middle and lower valleys of the Yangtze River. The project concluded that there existed two periods of intracontinental orogenic processes in eastern China and proposed a new ore-formation model; established a model depicting the 3-D structure beneath the ore-concentrated areas, and put forward a model of “multistage magmatic system”, which provided a theoretic reference for further delineating new targets of ore prospecting.



A sketch showing the dynamic pattern of intracontinental orogeny in the middle and lower reaches of the Yangtze River

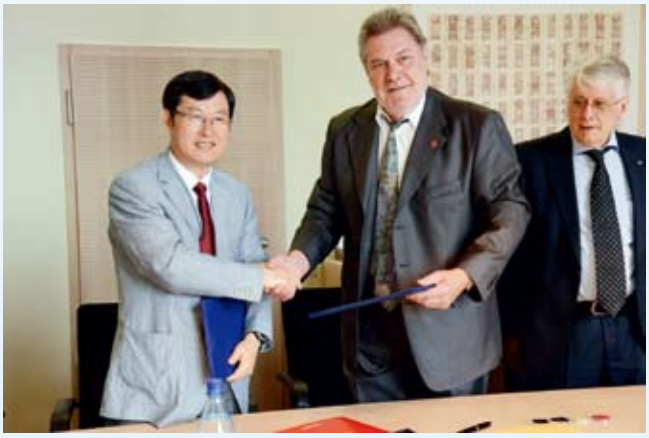
Chapter VIII International Collaboration and Academic Exchanges

In 2014, 166 international cooperation and exchange opportunities were realized involving 536 persons in total, including 265 Chinese scientists and engineers travelling overseas for 106 projects and 271 experts from abroad to participate in 106 relevant projects in China.

1 Steadily Promoting Major Bilateral and Multilateral Cooperation

(1) Cooperation with the Johannes Gutenberg University Mainz

On August 22, 2014, Dong Shuwen, Vice President of the CAGS and Prof. Wolfgang Hofmeister, Vice President for Research, the Johannes Gutenberg University Mainz signed a Memorandum of Understanding to promote bilateral cooperation. The two parties will carry out cooperation in regard to geoscientific research and education training through mutual visits, jointly launching and conducting scientific and education projects, jointly organizing academic symposiums, exchanges of information of science and technology, and education.

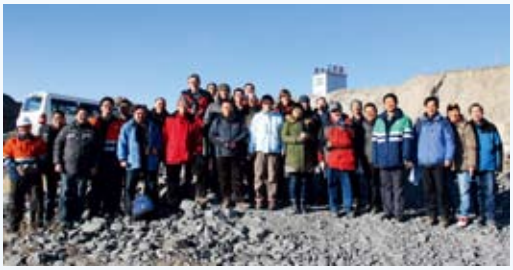


Signing ceremony of the Memorandum of Understanding

The CAGS delegates and the representatives of Johannes Gutenberg University Mainz

(2) China-Russia Cooperation

In light of the cooperation project "Correlation Study on the Permian LIPs on Emeishan of China and Siberia of Russia", a delegation of 9 members from the A. P. Karpinsky Russian Geological Research Institute (VSEGEI) visited China during December 14~21, 2014. Accompanied by scientists from the CAGS, they went to the Jinchuan nickle deposit in Gansu Province and the Jiaodong gold deposit in Shandong Province for field investigation and academic exchanges. Through their mutual discussions, their cooperation plan was worked out, and they also visited the Xi'an Investigation Center, CGS and had academic exchanges.



Chinese and Russian experts making field investigation in the Jinchuan nickle deposit

Chinese and Russian experts making field investigation in the Jiaodong gold deposit

(3) Smooth proceeding of the third-phase work of the Five-country Cooperation Project

The 12th working conference of the Five-country Cooperation Project was held in Daejeon, Republic of Korea on September 15~19, 2014. A delegation of six members headed by Prof. Dong Shuwen, Vice President of the CAGS and Academician Li Tingdong visited Korea and the attending parties signed a Protocol during the conference. They drafted the work plan for the period of 2014—2015, including the compilation of 1:5M magnetic anomaly map, 1:5M geochemical map, overburden and crustal thickness map. After the conference, they went to the western coast of the Korean Peninsula to conduct a field investigation into the composition and deformation of the Precambrian basement and the Mesozoic volcanism.

Delegation heads of the five countries signing the Conference Summary

Field investigation in the western coat area of Korea Peninsula

2 Major Academic Conferences held in China

(1) International Workshop on Ophiolites, Mantle Processes and Related Ore Deposits

On April 14~15, organized by the State Key Laboratory of Continental Tectonics and Dynamics, the International Symposium on Ophiolite, Mantle Processes and Related Ore Deposits was held in Beijing. Over 20 world famous scientists were invited to be present and delivered presentations. Mr. Wang Yan, Vice President of the CGS was present at the opening ceremony and gave a speech.

A group photo of participants at the International Workshop

(2) The 12th International Conference on Salt Lake

Sponsored by the CAGS and organized by the Institute of Mineral Resources and MLR Key Laboratory of Salt Lake Resources and Environment, the 12th International Conference on Salt Lake was held in Langfang City, Hebei Province on July 14~16, 2014. The symposium was attended by more than 300 participants from over 10 countries with the theme of "Salt Lake in the Future, Global Sustainable Research and Development". Dr. Zhong Ziran, President of the CGS, delivered an opening address. Field investigations were arranged after the symposium in Qinghai Salt Lake in Qinghai and Yuncheng Salt Lake in Shanxi.

Zhong Ziran gives a speech on the opening ceremony

A group photo of participants of the Symposium

(3) The 14th Quadrennial International Association on the Genesis of Ore Deposits Symposium

The conference, sponsored by the International Association of the Genesis of Ore Deposits and organized by the CAGS, Institute of Mineral Resources and Yunnan Bureau of Geological Survey, was held in Kunming City, Yunnan Province on August 19~22, 2014.

More than 750 scientists from 18 countries participated in the symposium. Wang Yan, Vice President of the CGS, delivered an opening speech. Under the theme "Mineral Resources: Discovery and Utilization", the symposium conducted four-day discussions on 19 hot topics, including ore-forming process of large to superlarge deposits, ore-forming process of porphyry Cu (±Au, Mo) deposits, skarn deposits, IOCG deposits, carlin-type gold deposits, etc. The symposium received abstracts of 822 academic papers and arranged 8 post-symposium field trips for geological investigation in Yunnan, Guizhou, Shandong and Jiangxi provinces in addition to Laos.

Mao Jingwen, Chairman of the Conference, gives a presentation

The venue of the Conference

3 Active Cooperation with International Organizations

(1) Cooperation with the UNESCO

(a) A visit to the CAGS

On September 1, 2014, Director Han Qunli of the Ecology and Earth Sciences Department of the UNESCO and Hans Thulstrup, Program Specialist in Natural Sciences in the Beijing Office at UNESCO and their two colleagues paid a visit to the CAGS. They exchanged ideas with relevant officials and researchers of the CAGS on the cooperation of the two sides with regard to international geological projects, geoparks and the Category II centers of the UNESCO. Vice President Dong Shuwen of the CAGS, Deputy Director-General Chen Xiaoning of the Department of Geological Environment, MLR, and Deputy Director-General He Qingcheng of the Department of Science, Technology and International Cooperation, CGS met with the visitors.

Director Han Qunli from the UNESCO and his group visit the CAGS

(b) Attending the 6th International UNESCO Conference on Global Geoparks

On September 18~22, 2014, the 6th Conference on World Geoparks of the UNESCO was held in Canada and the conference had about 500 participants from over 30 countries. Prof. Wang Xiaolie, Executive Vice President of the CAGS and Director of the China Geoparks Network led the Chinese delegation to attend the conference. The delegation size up the study frontier and development in such aspects as investigation, protection and scientific utilization of geologic relics in foreign countries and shared with them the experience and achievements of the management and construction of geoparks in China. The Chinese delegation presented to the conference the abstracts of 5 scientific papers and a special exhibition to review the development of global geoparks in China during the past 10 years. They attended the Global Geoparks Network Bureau Meeting, Global Geoparks Network General Conference, and International Symposium on UNESCO Designated Places.

A group photo of Chinese delegates attending the Conference

(c) Cooperation with the International Research Center on Karst

(i) Actively promoting the construction of a State-level international research center

The Secretariat of the International Research Center on Karst Dynamic System and Global Change drafted "Proposals for the Program on the Establishment and Six-year Construction of the Center" on April 3, 2014, and formalized its operation and organization. After the general goal of the Center during 2014—2020 was decided, a more detailed plan for 2014—2015 and a construction plan for 2016—2020 were worked out.

(ii) More research projects formulated

The following research projects were newly initiated in the International Research Center on Karst in 2014: China-Germany cooperation project "Bioindicators and Biomonitors in Organic Pollution Assessment at Karst Water Environment", China-Slovenia Intergovernmental scientific and technological cooperation project "Correlation Study of karst Processes and Carbon Sequstration under China monsoon and Slovenia Subcontinental Climates" and the overseas geological project of the CGS "Mapping of Karst Geology and Environmental Geology in China and Southeast Asia". On May 11, 2014, a work conference on karst environment geological maps of China and Southeast Asia was held and nine experts from China, Vietnam, Thailand and Malaysia gave key-note reports on protection of mining geological environments.

Work conference of the project "Mapping of Karst Geology and Environmental Geology in China and Southeast Asia"

(iii) International Symposium on Sustainable Utilization of Water Resources in Developing Countries

Organized by the International Research Center on Karst and the Institute of Karst Geology, CAGS, and hosted by African Institute of Groundwater Resources, University of the Western Cape and Guilin College of Technology, the International Symposium on Sustainable Utilization of Water Resources in Developing Countries was held on October 26~28, 2014. It was attended by over 90 scientists from 12 countries and regions, such as China, the US, Germany, Mongolia, Russia, Zimbabwe, Laos and Thailand. The Symposium covered such topics as progress on the hydrogeologic investigation in China, features of karst groundwater in southwestern China, discharge and treatment of acid wastewater in mining areas in South Africa, supply of manageable aquifer, treatment of sewage in wetland as well as utilization and management of water resources in aquifer in karst areas.

(iv) The 6th International Training Class of the International Research Center on Karst

On October 15~28, 2014, the International Research Center on Karst organized the 6th training course on karst ecological systems and geological microorganisms, which was attended by 17 researchers from 14 countries, including Laos, Russia, Serbia and South Africa. 18 experts from the US, Serbia, Slovenia and China were invited to give lessons in the training course. The classes in laboratories focused on karst ecological systems, karst dynamics and geological microorganism, while field classes were based on the Yaji Karst Hydrogeological Experimental Ground, Haiyang-Zhaidi Experimental Ground of Subground River System and Maocun Karst Experimental Ground.

A field class of the training course

A class in a laboratory

(d) Cooperation with the International Center on Global-scale Geochemistry

The UNESCO approved the establishment of the International Center on Global-scale Geochemistry in 2013. This year a number of international training classes were organized for geochemical mapping with a view to raising the level of geochemical mapping in developing countries. The training classes include geochemical mapping lectures for the Geological and Mineral Research Class from Congo-Kinshasa, lectures on laboratory and field sampling techniques in geochemical mapping for the Bureau of Geological Survey from Papua New Guinea, lectures on field sampling techniques in geochemical mapping for geological survey technicians from Laos.

(e) Advancing the work of the China National Committee for IGCP

The China National Committee on IGCP held its annual meeting in Beijing on December 25~26. Secretary-General Dong Shuwen, entrusted by Director Liu Dunyi, delivered the report on the work of the Commission in 2014, and the leader of the Chinese working group of the IGCP project introduced the major academic results and scientific activities carried out in 2014 and the focus of work of 2015.

Prof. Wang Xueqiu, Research Fellow of the International Center on Global-scale Geochemistry reported

progress in the work and working plan of 2015. Mr. Hong Tianhua, Deputy Executive Director and Secretary General of the International Center on Space Technologies for Nature and Culture heritage under the Auspices of UNESCO, was invited to introduce the major results of the Center in academic research and international cooperation in the past years. The annual meeting set the key tasks for 2015.

Annual meeting of the China National Committee of IGCP

(2) Work of the Secretariat and Treasurer of the IUGS

(a) 2014 China Mining Congress & Expo

The IUGS was invited for the first time to assume the role of co-organizer of the congress. This would provide a platform favorable for deepening the exchanges among the global geoscientific and mining communities, especially Chinese mining communities. During the conference, a special forum was held on the research initiative "Resourcing Future Generations" (RFG)— "Ensuring the Supply of Raw Materials for the Next Generation". Dr. Edmund Nickless, Chairman of the New Activities Strategic Implementation Committee (NASIC), hosted the forum and Prof. Roland Oberhänsli, Chairman of the IUGS, and other speakers gave their presentations at the forum, including experts from the USGS, BGS, Council for Science and Industrial Research of South Africa, Queensland Center for Advanced Technology, Australia, Université Joseph Fourie, France.

The forum had more than 100 participants. The launch of Action Plan RFG suggests that the IUGS has reoriented its development direction, namely, international geoscientific research will return to a study concerning resources from a pure academic one, and equal emphasis should be given to both resources and environment in order to ensure sustainable development of mankind. The Secretariat of the IUGS did its supplementary work for preparing the forum and associated exhibition.

Forum of Action Plan RFG

Prof. Roland Oberhänsli made an address at the Forum of Action Plan RFG

(b) Global-scale Geochemical Mapping

On October 22, 2014 Dr. Zhong Ziran, Vice Minister for Geological Survey of the MLR and President of the CGS, met with President Prof. Roland Oberhänsli, Secretary General Prof. Jose-Pedro Calvo-Sorando and Treasurer Prof. Dong Shuwen from the IUGS and the leading members of the New Activities Strategic Implementation Committee. They signed the Memorandum of Understanding on Global-scale Geochemical Mapping Between CGS, MLR of China and International Union of Geological Sciences, aiming at promoting the global-scale geochemical mapping by supporting the operation of the International Center on Global-scale Geochemistry and Working Group on Global Geochemistry Baselines under IUGS/International Association of GeoChemistry.

Dr. Zhong Ziran and Prof. Roland Oberhänsli sign the Memorandum of Understanding

(c) Other affairs finished

On February 7~10, 2014, Prof. Dong Shuwen along with staff members of the Secretariat of the IUGS went to India to lead and participate in the Bureau Meeting and the 67th Executive Committee Meeting of the IUGS. The Secretariat organized the meeting of the Executive Bureau in Potsdam, Germany and in Beijing, China on August 18-19 and October 20, 2014 respectively, and undertook the routine work of the Secretariat and the Treasure.

(3) Commission for the Geological Map of the World (CGMW)

Approved by the MLR, the CAGS nominated Prof. Wu Zhenhan as China's official representative to the CGMW in early 2014, in charge of communication and coordination between China and the CGMW. On February 18~23, 2014, a 6-member delegation of the CAGS headed by Vice President Wu Zhenhan attended the 2014 annual conference of the CGMW at the UNESCO Headquarters in Paris, France. At this conference, Prof. Jin Xiaochi, on behalf of Academician Ren Jishun gave a report on the progress of the compilation of the Geological Map of Asia and put forward a suggestion on developing the Tectonic Map of South-Central Asia.

Prof. Jin Xiaochi presents a report on the progress of the Map Compilation Project

(4) Joining the University of the Arctic (UArctic)

(a) Application

The UArctic was founded in 2001, acting as a cooperative network engaged in research on the Arctic with more than 160 members. Acting on the recommendation of the Department of Science, Technology and International Cooperation, MLR, and approved by the Department of Treaty and Law, MFA, the CAGS applied for membership in the UArctic. Zhao Yue was nominated as the representative and Nie Fengjun as the deputy representative of the CAGS in the UArctic. The CAGS will attend the Council

meeting of the UArctic for official approval.

(b) Vice President of the UArctic paying a visit to the CAGS

In order to move ahead the work of applying for membership in the UArctic, the CAGS received the invited Vice President of the UArctic and Director of International Relations of the University of Lapland, Finland, Mrs. Outi K. Snellman, who visited the State Key Laboratory of Continental Tectonics and Dynamics on June 20, 2014. Vice President Dong Shuwen and relevant officials and researchers had a discussion concerning CAGS's application for joining the UArctic.

4 International Cooperation Award

Recommended by the CAGS and submitted by the MLR, Prof. Francesco M. Pirajno from the Geological Survey of Western Australia won the China International Science and Technology Cooperation Award, and also received a title of Honorary Research Follow of the CAGS.

Prof. Francesco M. Pirajno is a world renowned researcher in the study of mineral geology and mineral exploration. In the past decade, Prof. Pirajno and scientists from the Institute of Mineral Resources, CAGS have conducted cooperative studies on mineral geology and exploration. Thanks to his assistance, several difficult problems either in theoretical study or in field exploration have been solved. He has helped the CAGS train a number of leaders of research projects and graduates in the study of ore deposits and made efforts to introduce and recommend outstanding Chinese geologists and research achievements to the international stage with over 20 SCI-indexed research papers published in overseas academic journals, thus having narrowed the gap between the CAGS and the global geological communities in the study of ore deposits, and raised the international position and stature of the CAGS in this field.

Prof. Pirajno wins the Award for International Scientific and Technological Cooperation of the People's Republic of China

Prof. Pirajno receives the title of the Honorary Research Fellow of the CAGS

5 Scientists of the CAGS holding posts in international academic organizations

Name	Academic Organization or International Journal	Position	Term
Cao Jianhua	Commission on Karst Geology, International Association of Hydrogeologists (IAH)	Member	Since 2009
Ding Tiping	Inorganic Chemistry Division, International Union of Pure and Applied Chemistry (IUPAC)	Titular Member	2012-2013
Dong Shuwen	International Union of Geological Sciences (IUGS)	Treasurer	2012-2016
	Akadernie gemeinnütziger Wissenschaften zu Erfurt	Member	Since 2011
	Geological Society of America (GSA)	Honorary Fellow	Since 2013
He Shiyi	Commission on Karst Geology, IAH	Member	Since 2009
Hou Chuntang	International Consortium on Geo-Disaster Reduction	International Advisor	Since 2014
Hou Zengqian	Society for Geology Applied to Mineral Deposits (SGA)	Regional Vice-President	2011-2013
	Resources Geology	Senior Editorial Board Member	Since 2009
	Society of Economic Geologists (SEG)	Regional Vice-president, Lecturer	Since 2014
Ji Qiang	Asia Dinosaur Association	Vice President and Secretary General	Since 2013
Jiang Guanghui	Commission on Karst Geology, IAH	Vice President	Since 2010
Jin Xiaochi	Subcommission on Carboniferous Stratigraphy, International Commission on Stratigraphy (ICS)	Voting Member	2004-2016
	Scientific Board of the International Geoscience Programme (IGCP), UNESCO	Member	2009-2016
	Subcommission on South and East Asia, Commission for the Geological Map of the World (CGMW)	Deputy Secretary General	Since 2010
	Global Geoparks Network (GGN) Bureau	Member	Since 2013
Kong Fanjing	International Society for Salt Lake Research (ISSLR)	Member-at-large	2012-2014
Liu Pengju	Subcommission on Ediacaran Stratigraphy, ICS	Corresponding Member	2012-2016
Liu Shoujie	*Gondwana Research*	Associate Editor-in-Chief	Since 2013
Long Changxing	Global Geoparks Network (GGN) Bureau, UNESCO	Member	Since 2010
Luo Liqiang	*X-Ray Spectrometry*	Associate Editor-in-Chief	Since 2003
	Journal of Radioanalytical and Nuclear Chemistry	Associate Editor-in-Chief	Since 2006

Continued

Name	Academic Organization or International Journal	Position	Term
Lü Junchang	Asia Dinosaur Association	Deputy Secretary General	Since 2013
Mao Jingwen	International Association of the Genesis of Ore Deposits (IAGOD)	President	2012-2016
	Ore Geology Reviews	Associate Editor-in-Chief	Since 2002
Nie Fengjun	*Resource Geology*	Senior Editorial Board Member	Since 2007
	Scientific Board of the International Geoscience Programme (IGCP), UNESCO	Member	2009-2016
Pei Rongfu	Commission on Paragenesis, International Association on the Genesis of Ore Deposits	Officer	Since 1993
	Commission on Paragenesis, IAGOD	Officer	Since 1995
Ren Jishun	Commission for the Geological Map of the World (CGMW)	Vice President	Since 2004
Shi Jusong	Committee on Neotectonics and Geohazard, International Association for Engineering Geology and the Environment (IAEG)	Deputy Secretary General	Since 2008
	International Consortium on Geo-disaster Reduction	Assistant to the President	Since 2014
Sun Ping	*Landslides*	Editorial Board Member	Since 2009
	International Consortium on Geo-Disaster Reduction	Editorial Board Member	Since 2014
Wang Jun	Commission on Management and Application of Geoscience Information, IUGS	Observer	Since 2010
Wang Wei	Permanent Secretariat of the International Union of Geological Sciences	Director	Since 2013
Wang Xueqiu	Association of Applied Geochemists (AAG)	Regional Councilor	Since 2004
	Task Group on Global Geochemical Baselines (TGGGB), IUGS	Co-Leader	Since 2008
Wu Shuren	Committee on Neotectonics and Geohazard, IAEG	Member	Since 2008
Xie Xuejin	*Geochemistry Exploration·Environment·Analysis*	Editorial Board Member	Since 2004
	Journal of Geochemical Exploration	Editorial Board Member	Since 1999
Yang Jingsui	Geological Society of America (GSA)	Fellow	Since 2011
	Mineralogical Society of America (MSA)	Fellow	Since 2009
Yang Zhenyu	Publications Committee, IUGS	Member	2011-2014

Continued

Name	Academic Organization or International Journal	Position	Term
Yao Jianxin	Subcommission on Triassic Stratigraphy, ICS	Corresponding Member	Since 2011
Yin Chongyu	Subcommission on Ediacaran Stratigraphy, ICS	Voting Member	2012-2016
Yin Ming	*Journal of Geostandards and Geoanalysis*	Editorial Board Member	Since 2006
Yuan Daoxian	Commission on Karst Geology, IAH	Member	Since 1988
Zhao Yue	Standing Scientific Group on Geosciences, Scientific Committee on Antarctic Research	Delegate	Since 2002
	Committee on Neotectonics and Geohazard, International Association for Engineering Geology and the Environment (IAEG)	Member	Since 2008
Zhang Cheng	Commission on Karst Geology, International Association of Hydrogeologists (IAH)	Member	Since 2009
Zhang Ronghua	*International Journal of Material Science*	Editor	Since 2006
	Commission on Industrial Minerals and Rocks, IAGOD	Vice Chairman	Since 1994
Zhang Yongshuang	Committee on Neotectonics and Geohazard, International Association for Engineering Geology and the Environment (IAEG)	Secretary General	Since 2008
Zhang Zeming	*Gondwana Research*	Associate Editor-in-Chief	Since 2011
Zheng Mianping	International Society for Salt Lake Research (ISSLR)	Vice President	2002-2014
Zhu Yangkun	Commission on Isotopic Abundances and Atomic Weights	Titular Member	2010-2016

Chapter IX Graduate Education and Postdoctoral Work

The goal of the graduate and postdoctoral education program of the CAGS is to cultivate high-caliber professionals in geosciences.

1 Graduate Education

The CAGS is the only institution under the MLR that is authorized to offer doctoral degrees and to establish postdoctoral research stations. Graduate education of the Academy began in the early 1960s and at present there are 2 Ph.D authorized institutions of the first-level subjects (geology and geological resources and geological engineering), 8 specialized subjects for doctoral degree and 11 specialized subjects for master's degree, as well as 2 research stations of geology and geological resources and geological engineering. The graduate work of the Academy has been supported by 16 departments and institutions affiliated with the CGS. There are over 100 Ph.D supervisors and nearly 300 teachers for master students. We have adopted a two-step mode in graduate training: all basic curricula are finished in universities or colleges, while the task of improving the ability to do scientific research and completing theses and dissertations is left to the training institutions, so that the resources of both universities and the CAGS can be most fully utilized. Up to now, a great many talents possessing a solid theoretical foundation and strong ability in geological research were educated, including 1674 graduates and 279 postdoctorates.

Field practice and teaching at Mentougou, Beijing

Field practice and teaching in Zhoukoudian, Fangshan District, Beijing

2 Disciplines of Graduate Education

The degree-authorized disciplines belong to two fields: science and engineering, including 5 subjects: geology, geological resources and engineering, chemistry, geophysics, and mining engineering. In 2014, graduates were admitted in 64 research areas of 8 doctorate-authorized subjects and 80 research areas of 11 master degree- authorized subjects.

Degree authorization of the CAGS

Field	First-level subject	Specialty	Degree	
			Doctorate	Master
Science	Chemistry	Analytical chemistry		★
	Geophysics	Solid-earth physics		★
	Geology ★	Mineralogy, petrology and study of mineral deposit	★	★
		Geochemistry	★	★
		Paleontology and stratigraphy, including paleoanthropology	★	★
		Tectonic geology	★	★
		Quaternary geology	★	★
Engineering	Geological resources and geological engineering	Mineral reconnaissance and exploration	★	★
		Earth probing and information technology	★	★
		Geological engineering	★	★
	Mining engineering	Mineral processing engineering		★

★ Authorized subjects and specialties

The 5th Graduate Autumn Sports Meeting

3 Graduates admitted in 2014

In 2014, 64 Ph.D candidates and 80 master students were enrolled, among whom 29 Ph.D candidates were jointly trained by the Academy along with Peking University, China University of Geosciences (Beijing) and China University of Geosciences (Wuhan); 40 master students were jointly trained by the Academy and China University of Geosciences (Beijing).

Graduates of the CAGS enrolled in 2014

Specialty	Number of graduates			
	Doctorate	Master	Doctorate by joint training	Master by joint training
Analytic chemistry	—	2	—	0
Solid-earth physics	—	3	—	0
Mineralogy, petrology, study of mineral deposit	7	10	8	6
Geochemistry	3	5	2	6
Paleontology and stratigraphy	1	1	2	4
Tectonic geology	9	8	10	3
Quaternary geology	0	2	0	0
Mineral reconnaissance and exploration	3	1	1	0
Earth probing and information technology	3	0	0	1
Geological engineering	9	7	6	2
Mineral processing engineering	—	1	—	0
Geological engineering (for specialty degree)	—	—	—	18
Total	35	40	29	40

CAGS graduates won the champion at the 4th Table Tennis Team Competition

4 Academic Degrees Received by Graduates in 2014

In 2014, 37 doctorate and 31 master's students finished their courses and graduated. 36 students received Ph.D degrees and 31 had master's degrees. 68 graduates, as first authors, published 180 research papers in Chinese and international academic journals, including 52 SCI-indexed papers (16 in international SCI-indexed journals) and 27 EI-indexed papers.

Graduates of the CAGS who finished school in 2014

Specialty	Number of graduates		Number of graduates	
	Doctorate	Master's	Doctorate	Master's
Analytic chemistry	—	2	—	2
Solid-earth physics	—	1	—	1
Mineralogy, petrology, study of mineral deposit	6	8	6	8
Geochemistry	3	6	3	6
Paleontology and stratigraphy	0	3	0	3
Tectonic geology	15	4	14	4
Quaternary geology	0	2	0	2
Mineral reconnaissance and exploration	3	0	3	0
Earth probing and information technology	4	1	4	1
Geological engineering	6	3	6	3
Mineral processing engineering	—	1	—	1
Total	37	31	36	31

A group photo of graduates who finished school in 2014

Li Tingdong, Director of the Academic Degrees Committee of the CAGS, confers degree on a graduate student

5 Awards

Shi Xingjun and 7 other graduates and Liu Fan and 4 other graduates jointly trained by the CAGS and other universities were granted the national scholarships, Gao Li'e and 4 other graduates received the Cheng Yuqi Award for Outstanding Graduates, Huang Guanxing and 4 other graduates won the Chen Yuqi Award for Outstanding Degree Theses, 1 master student received the Li Siguang Award for Outstanding Graduates, 4 students received outstanding graduate awards issued by Beijing Municipality, 6 students were chosen as outstanding graduates of the Academy and 31 graduates received the honorary title of "Meritorious Student".

Chen Yuqi Award for Outstanding Degree Theses in 2014

Title of thesis	Author	Supervisor
Impact and Control Mechanisms of the Geochemical Environment on the Ageing of Arsenic in Vadose Zone	Huang Guanxing	Chen Zongyu
Metamorphic Evolution and Geochronology of the Wulashan-Daqingshan Complex, the Khondalite Belt	Cai Jia	Liu Fulai
Temporal-Spatial Distribution and Tectonic Evolution of the Granitoids in the Altun Orogenic Belt	Liu Chunhua	Xu Zhiqin
The Formation Mechanism of Datangpo Manganese Formations of Nanhua Periods in South China and the Paleo-redox Conditions of Nanhua Marine Basin	Zhang Feifei	Zhu Xiangkun
The Alteration and Mineralization Character of Scientific Deep Drilling in Anhui Luzong Basin	Xiong Xin	Xu Wenyi, Yang Zhusen

Wang Yan, Deputy Director-General of the CGS, Academician Sheng Qihan and Mr. Cheng Xuelin, son of late Prof. Cheng Yuqi, confer the Cheng Yuqi Award on Outstanding Graduates

Leaders of the CGS confer awards on merit graduates

Academician Xiao Xuchang confers awards on outstanding graduates

6 Postdoctorate Program

In 2014, 38 researchers were enrolled in the postdoctorate program, among whom 21 engaged in geology and 17 in geological resources and geological engineering, with an average age of 30. Eleven of them were recruited jointly by the Academy and the postdoctoral program, 4 members of the research program received financial assistance from the National Natural Science Foundation of China, 1 was supported by the 2014 Hong Kong Scholar Program, 8 by the youth foundation of the National Natural Science Foundation of China, and 3 received special research funds from relevant institutes.

In 2014, 29 postdoctoral fellows finished their research programs. They published 38 SCI-indexed scientific papers as the first authors and participated in 56 research projects, 20 of these projects headed by them. Among the above postdoctoral fellows, 15 worked in the institutions running the research programs, 12 joined other organizations and 2 returned to their original units

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Chapter X Major Activities in 2014

1 CAGS Work Conference of 2014 Held in Beijing

On March 21, 2014, the CAGS held the 2014 Work Conference in Beijing. Deputy Director Zhai Lixin from the MST, Director Jiang Jianjun of the Department of Science, Technology and International Cooperation, MLR, Deputy Director-General Wang Xuelong of the CGS attended and addressed the conference. Wang Xiaolie, Party Committee Secretary and Vice President of the CAGS, delivered a report entitled "Consolidating accomplishments and deepening reform, comprehensively advancing geological science and technology innovation". Participants in the conference had intensive discussion on such topics as the relationship between geological science and technology and geologic investigation, integration of scientific research and geological investigation, increasing the capacity for original innovation, support of geological science and technology for making breakthroughs in mineral prospecting and construction of ecological civilization, and pilot programs of scientific innovation. The conference clarified the thoughts and objectives in our work, and thus attained its anticipated objective.

In his speech, Wang Xuelong stressed that the CAGS should clearly recognize the current situation and identify its correct position, saying that we should move ahead to coordinate development of geological investigations from a big-picture view on geology, resources and ecology, seriously carry out trials of scientific innovation, solve crucial technological problems relating to environmental resources, notably raise the capacity for geological science and technology innovation and make contributions to breakthroughs in exploration of mineral and energy resources and to the development of ecological civilization.

The work report laid out an overall plan for the major tasks of the CAGS in 2014: first, taking solid steps to advance the pilot program of scientific and technological innovation; second, seriously carrying out research on innovation and implementing research projects; third, enhancing supporting services for science and technology; fourth, making more efforts to cultivate and attract high-caliber scientific and technological talent; fifth, deepening international scientific and technological cooperation and academic exchanges; sixth, strengthening the construction and operation of science and technology platforms; seventh, improving management work and raising the ability of coordination in our work; eighth, intensifying Party building and promoting spiritual civilization; ninth, consolidating the results of the campaign to raise public awareness of the party policies and improve party-people relations.

The 2014 Work Conference of the CAGS

Leaders inspect the Qinglongqiao Base

Research teams receiving awards for the Top Ten Geological Scientific and Technological Advances

2 Making Solid Progress in Strategic Cooperation of Enterprises, Universities and Research Institutions

On January 8, 2014, Wang Xiaolie, Party Committee Secretary and Vice President of the CAGS, and Deng Wei, Board Chairman of the Yiyang Group, signed a strategic cooperation agreement in Beijing. In light of the agreement, the two parties will set up long-term and stable cooperation in such areas as multipurpose utilization of tailing resources, acquisition of global mineral resources and development of mineral prospecting techniques. The two parties were planning to strengthen coordination and innovation and build platforms for joint research and application development by linking enterprises, universities and research institutions together, and conduct applied technology studies and promote transfer of scientific and technological results through integrating resources of talents, technology, capital and information.

The CAGS and the Yiyang Group sign the Strategic Cooperation Agreement

Discussion on the cooperation of the CAGS and the Yiyang Group

On January 15, 2014, the CAGS and China University of Geosciences (Wuhan) signed an agreement in Beijing on jointly developing a 5000 t multifunctional press and building a world-class high-temperature and high-pressure laboratory for deep earth materials. The cooperation is expected to make breakthroughs in modeling the rock environment and geological process of the crust and upper mantle, deep seismic, metallogenic mechanisms, energy development and development of new materials.

The CAGS and China University of Geosciences (Wuhan) sign an agreement

On May 9, 2014, the CAGS, the Institute of Vertebrate Paleontology and Paleoanthropology, CAS, and institutions related to protection of paleozoologic fossils signed an agreement in Beijing on protection and development of paleozoologic fossils in the Linxia basin, Gansu Province. The three parties agreed to set up a steering committee with Academician Zhou Zhonghe from the CAS as Director and Vice President of the CAGS as deputy Director.

On May 26, 2014, Wang Xiaolie, Party Committee secretary of the CAGS and General Manager of the Southwest Energy and Mineral signed a strategic cooperation framework agreement in Guiyang. The two parties agreed to build a long-term and stable cooperation in the fields of prospecting and utilization of mineral resources, building platforms for science and technology innovation and transfer of scientific and technological results. The two parties were planning to strengthen coordination and innovation, build platforms for linking enterprises, universities and research institutions together, conduct study of applied technologies and promote transfer of scientific and technological results through integrating resources of talents, technology, capital and information.

The CAGS and the Southwest Energy and Mineral signed the strategic cooperation framework agreement

On July 7, 2014, the CAGS and the Southwest Energy and Mineral signed an agreement in Beijing on jointly building work stations for academicians and post-doctorates. This is a significant measure with the purpose of implementing the cooperation framework agreement, building platforms for joint research and application development by linking enterprises, universities and research institutions together, training high-rank scientific professionals and serving the sustainable development of the economy and society of Guizhou Province.

The CAGS and the Southwest Energy and Mineral signed an agreement on jointly building work stations for academicians and post-doctorates

3 Annual Report Conference of the SinoProbe Program

On October 20~23, 2014 the annual academic conference of SinoProbe was held during the China Union of Geological Sciences Annual Meeting. The conference was attended by about 200 scientists and students of 49 subjects in 9 sub-programs. This academic event attracted notable attention of scientists and students, as well as relevant media.

Academic activities were carried out at the main venue, special sessions and exhibition.

Main Venue:

Prof. Dong Shuwen, PI of the Program, presented the general report "Deep exploration: to reveal the crustal structure, deep processes and metallogenic and disaster-forming backgrounds", introducing and summarizing the scientific findings, technological advances and breakthroughs the Program has made, and putting forward the future plan. Leaders of the eight projects under the Program reported their progress in such areas as standard continental magnetotelluric network experimentation, experimentation on deep probing technologies and integration, deep probing into 3D structure and geodynamic processes of ore districts, China geochemical baselines network, selected continental scientific drilling and experimentation, experimental study on the technique of in-situ stress measurement and monitoring, key instrument and equipment development and field experimentation.

More than 220 scientists and students participated in the conference.

Dong Shuwen, coordinator of the Program, delivers the general report

Special Sessions:

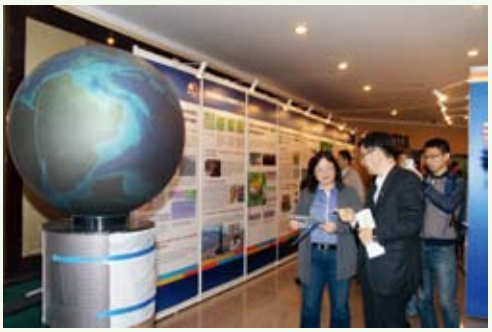
There were 5 special reports, focusing on exploration of fine structure of the earth crust, scientific drilling and global geochemical baselines, 3D exploration of ore deposit regions, in-situ stress measurement and geodynamic numerical simula 86 oral presentations and 45 posters and attracted about 250 researchers.

Participants listening to lectures

Exhibition:

The exhibition covered 38 square meters in 4 areas and demonstrated the major achievements of SinoProbe, which were classified into five parts including the history of SinoProbe, research results in digital forms, partnership between SinoProbe and global geological communities, popularization of related scientific knowledge, and major technical breakthroughs and scientific discoveries.

Exhibition of the SinoProbe Program



Visitors attending the exhibition

Since the program was initiated in 2008, a huge quantity (20 TB) of observed data about physical properties of solid earth and geochemistry have been collected based on the norm and procedure worked out for data submission and examination under the guidance of the MLR, MF and MST. At the conference, Prof. Dong Shuwen declared the data-sharing scheme and catalog of the first phase of data available for sharing, which have received a positive response from many scientific institutions, universities and even large enterprises.

4 Activities on the 45th World Earth Day

The 45th World Earth Day on April 22, 2014 was celebrated at the CAGS with the main theme of "Cherishing earth's resources and transforming the style of economic development—saving and intensively making use of land and resources and protecting natural ecological space". The laboratories and research centers affiliated with the CAGS were all open to the public and various science popularization activities were arranged. Young pioneers from the Li Siguang Squad of the Zhanlanlu Primary School went to the Key Laboratory of Salt Lake Resources and Environment, listened to scientific lectures and learned related scientific knowledge.

A group photo of teachers and students visiting the CAGS

A lecture of popular science

Boys observing samples

5 Speaking Contest

On May 4, 2014, the CAGS organized a speech contest in Beijing with the theme of "Chinese dream, geological dream and youth dream". 13 young workers of the CAGS gave their speeches, reviewing their careers, responsibilities and accomplishments and expressing their youthful sentiments and conviction to contribute their wisdom and vigor to the geological cause. Vice President Wang Xiaolie extended his greetings for the Youth Day to the young people engaged in geological science and technology and placed in them his ardent expectations for their future.

Speech contest

Chapter XI Academic Publications

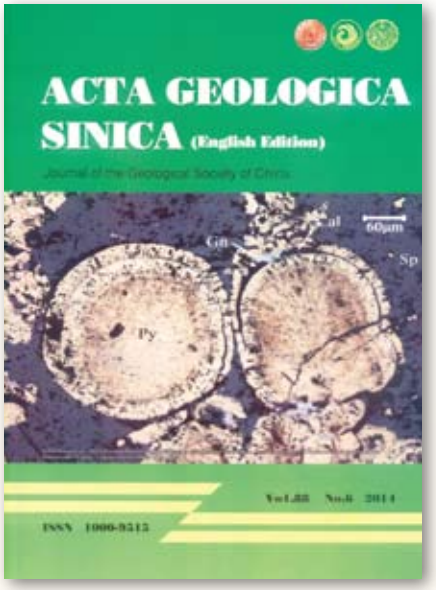
In 2014, 1117 research papers were published in academic periodicals by scientists of the Academy, with an increase of 16.6% over the previous year, including 371 SCI-indexed (up 64.89% from 2013), 114 EI-indexed papers and 25 monographs.

The CAGS and the GSC, whose administrative office is at the CAGS, are sponsoring 10 academic journals, including *Acta Geologica Sinica* (English edition) (indexed by SCI), *Acta Geoscientica Sinica* (indexed by EI), *Acta Geologica Sinica* (Chinese edition), *Mineral Deposits, Geological Review, Carsologica Sinica, Acta Mineralogica et Analytica* (indexed by CA), *Acta Petrologica et Mineralogica, Journal of Geomechanics* (China's core journal), and *Journal of Groundwater Science and Engineering* (English edition).

In 2014, the website of geoscientific journals of China (http://www.geojournals.cn/) was proven to be most active and heavily used, and covered more professional periodicals than any other geoscientific websites in China. The website attracted the extensive attention of overseas researchers from more than 10 countries beside China, such as the US, Canada, Germany, Australia, Japan, Mongolia. The website overcame language barriers to gain more and more attention from foreign countries.

ACTA GEOLOGICA SINICA (English edition) is sponsored by the GSC and started publication in 1922 with its former name *Bulletin of the Geological Society of China*. It is one of the scientific periodicals with a long history in China, bimonthly. The journal has been praised several times by the MST, Publicity Department of the Communist Party of China (PDCPC) and General Administration of Press and Publication (GAPP). It was selected into the China Scientific Periodical Array in 2001. During 2006—2014, the magazine received financial aid from the Project of A-category Outstanding Periodicals of the CAST. In recent years, notable progress has been made in magazine internationalization and the journal was chosen as the source item by more than 10 famous index references, digests and databases, including the Science Citation Index (SCI) and Chemical Abstracts (CA) of the Institute of Science Information of the US. The journal received financial support from the "special funds for key academic periodicals" of China National Natural Science Foundation during 2010—2011. This journal won the first prize of excellent international scientific periodicals and was included in the list of the Highest International Impact Academic Journals of China by the CAST and Ministry of Finance in 2012. It was chosen as one of the "top 100 newspapers and magazines" by

the State Administration of Press, Publication, Radio, Film and Television in 2013.



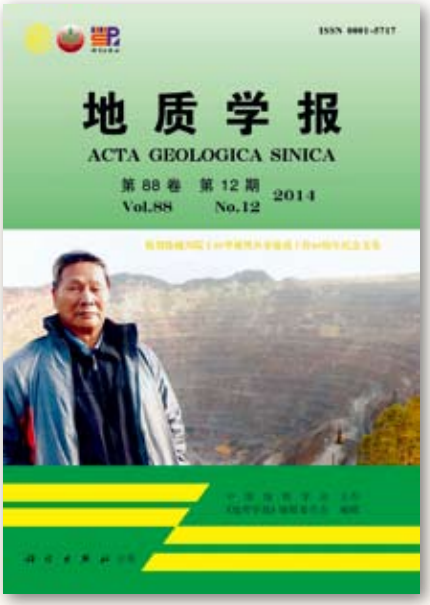
In 2014, *Acta Geologica Sinica* (English edition) had impact factor of 1.406 in JCR and the number of citations was 2358. Papers carried in this journal are comparable in terms of academic level with international academic media of the same kind. In 2014, it published 6 issues (1936 pages in total), carrying 132 scientific papers and 12 newsletters among 413 submitted papers. Among all published papers, 92% were supported by various founds and 31% (41 papers) were from overseas, such as Australia, Japan, India, Pakistan, Iran, Turkey, so as to extend international influence of this journal. A number of scientific papers of *Acta Geologica Sinica* introduced research achievements of Chinese scientists on the frontier of geosciences to demonstrate significant breakthroughs and show the international level of Chinese geological research. 22 of these papers reported and pursued hot topics in geoscience. In 2014, the Project for Enhancing International Impact of China STM Journals undertaken by *Acta Geologica Sinica* was smoothly completed. This journal was evaluated among high-quality printing materials in 2014 by the Beijing quality supervision department. All of the above achievements result come from long-term efforts in internationalization of scientific periodicals and mark a new level of the high quality of the journal.

Website: http://www.geojournals.cn/dzxbcn/ch/index.aspx/ (in China)

http://onlinelibrary.wiley.com/doi/10.1111/acgs.2014.88.issue-5/issuetoc (in other countries)

ACTA GEOLOGICA SINICA (Chinese edition) is sponsored by the GSC. Its predecessor was *Bulletin of the Geological Society of China*, one of the earliest scientific periodicals in China. *Acta Geologica Sinica* is dedicated to reporting the latest and most significant achievements in theoretical and basic research, as well as new techniques and methods of the geological community of China, monthly. The journal has been praised several times by the MST, PDCPC and GAPP and was selected into the China Periodical Array in 2001. In 2015, it won the National Journal Award and during 2006-2014 the journal received financial aid from the Project of B-category Outstanding Periodicals of the CAST. *Acta Geologica Sinica* was chosen as the source item by a number of index references both at home and abroad. According to statistics released by the Institute of Scientific and Technical Information of China (ISTIC), the impact factor and the total number of citations of *Acta Geologica Sinica* (Chinese edition) have taken the leading position among all scientific periodicals in China. It was included in the list of the Highest International Impact Academic Journals of China in 2012.

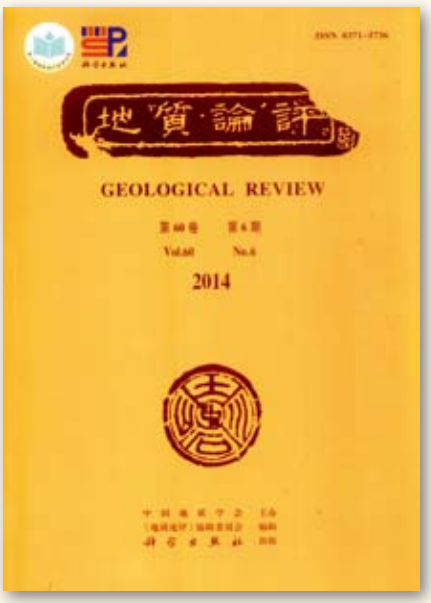
In 2014, 160 scientific papers (2600 pages in total) were published in *Acta Geologica Sinica* (Chinese



edition). 98% of the papers had financial aid from various funding sources and more than half of them were financially supported by major research projects, such as Project 973 and the National Natural Science Foundation of China. In addition, 2 special issues were published: *SinoProbe Monograph* and *Selected Papers of Academician Chen Yuchuan in Commemoration of the Eightieth Anniversary of His Birth and the Sixtieth Anniversary of His Engagement in Geological Work*, which is of significance in promoting scientific development. The impact factor of the journal was 1.770 in 2013 and the total number of citations was 4,430. The overall evaluation reached a score of 74.3. The impact factor and the number of citations ranked fourth and second respectively among the geoscientific journals. *Acta Geologica Sinica* (Chinese edition) has long drawn the attention of numerous contributors with a large number of papers submitted while it has a high rate of rejection, indicating an ample source of scientific papers to attract the readers of this journal.

Website: http://www.geojournals.cn/dzxb/ch/index.aspx

GEOLOGICAL REVIEW is sponsored by the GSC and started publication in 1936. The journal has long seen its mission as stimulating scientific debate and discussion as well as encouraging the exchange of ideas and research discoveries. The design for the four Chinese characters meaning "Geological Review" on the cover has its upper right and lower left rims chipped, implying that the territory of North China and Southwest China was encroached upon by invaders at the moment when *Geological Review* was born. This design has continued to be used ever since, expressing the continuing worry of Chinese geologists for the fate of their country. *Geological Review* is a bimonthly journal with the following distinctive features: Discussing, Commenting, Explicating and Reporting.

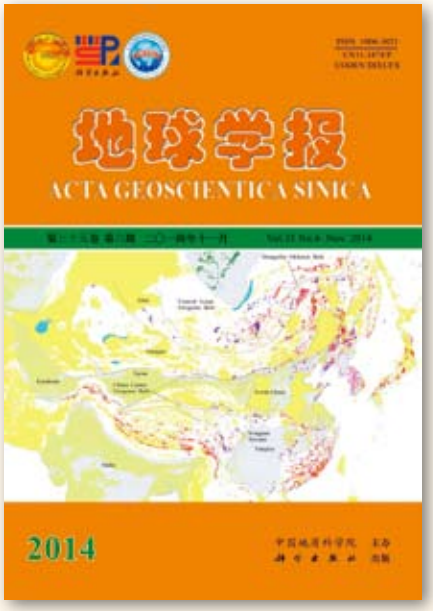


Geological Review is among China's core journals. The journal received the National Journal Award, Best Scientific Journal Award and the title of Double-Award Periodicals by the MST, PDCPC and GAPP. It has been indexed by a large number of Chinese index systems. According to statistics released by the ISTIC, the impact factor and the total number of citations were both in the front rank of the Chinese journals. It received nomination for the National Journal Award in 2005, was chosen among the Project of Outstanding S&T Journals of the CAST

in 2006, and was appraised as a journal among the Top-notch Academic Journals of 100 Categories by the ISTIC in 2009. It was included in the list of the Highest International Impact Academic Journals of China in 2012. In 2014, over 130 scientific papers were published in *Geological Review* in addition to more than 10 news releases. The impact factor was 1.112 in 2013 and the total number of citations was 2407. The overall evaluation had a score of 56.9, ranking fourth among geoscientific periodicals in China.

Website: http://www.geojournals.cn/georev/ch/index.aspx.

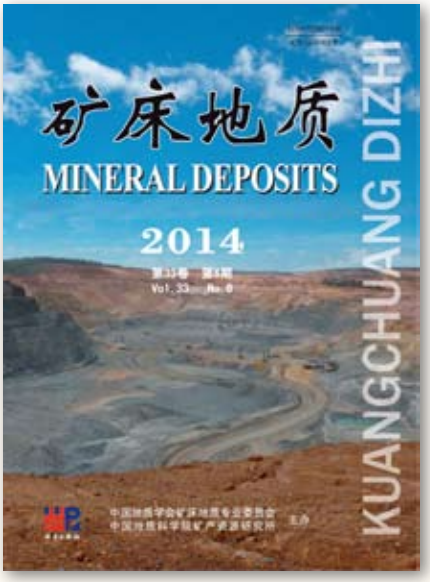
ACTA GEOSCIENTICA SINICA is a bimonthly journal sponsored by the CAGS and published by the Science Press. It is among China's core scientific journals, national core journals of natural science and national Chinese core journals. It is a source periodical for the statistics of Chinese scientific papers, a journal included in the database of outstanding S&T journals of China and a source item of the core CSCD. It was selected as the journal in the first batch of Outstanding S&T Journals of China. *Acta Geoscientica Sinica* ranks among the periodicals that have the total number of SCI citations higher than 100. It was indexed by EI and became the source item of EI in 2013. Since 2012, the journal was included in the Highest International Impact Academic Journals of China for three consecutive years. In 2013, the total number of citations was 1740 and the core impact factor was 1.263, ranking 87th among the 1989 core periodicals in China.



As an important window for showing a fine academic image of the CAGS, *Acta Geoscientica Sinica* is dedicated to fully reporting academic achievements and overall competitiveness of the CAGS in scientific research. The issues of *Geological Review* in 2014 published 10 papers reporting the top 10 Geological Scientific and Technological Advances of the CAGS in 2013 in addition to related pictures and stories. This journal published six issues (782 pages) in 2014, carrying 95 scientific papers and 25 various newsletters. The electronic version of the journal was available, and the full texts can be reviewed free and downloaded on its website.

Website: http://www.cagsbulletin.com

MINERAL DEPOSITS is sponsored by the Commission on Deposit Geology of the GSC and the Institute of Mineral Resources, CAGS. It is a bimonthly journal and began publication in 1982. This journal is the only periodical in China that covers the latest achievements in the study of mineral deposits, including geological characteristics of ore deposits, relevant research results and new techniques and methods in lithology, mineralogy and geochemistry. *Mineral Deposits* was indexed

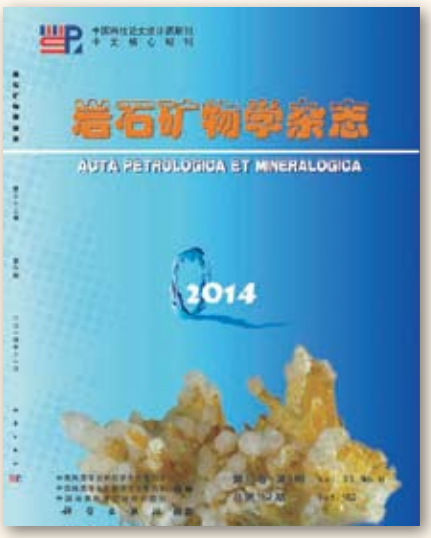


by such index references and databases as *Chemical Abstracts*, CSA Technology Research Database, Russia's digest magazine *Реферативный журнал*, CNKI, CSCD and CJFD, Digital Periodicals—Paper Database, Digital Periodicals—Citation Database, China Geological Digest, national press index database (natural science and technology), *Nonferrous Metallic Abstract* and *China Science Abstracts*.

In 2014, 96 scientific papers were published in *Mineral Deposits*. The journal has maintained a high number of papers reporting nationally funded research projects compared with other scientific periodicals in China. The impact factor was 1.551 in 2013, taking the 5th place among the journals in earth science and the 43rd place among all core scientific periodicals of 1984 categories in China. The total number of citations of this journal was 2423. *Mineral Deposits* again was included in the list of the Highest International Impact Academic Journals and the Outstanding S&T Journals of China. The Editorial Board of this journal took part in Project "Pacemaker 5000—top academic papers in China Fine S&T periodicals". According to the CSTPCD, 2 scientific papers published in this journal in 2013 were recommended to list in the CSTPCD database. In 2014, the website of *Mineral Deposits* received a click rate of nearly 6 million.

Website: http://www.kcdz.ac.cn/ch/index.aspx

ACTA PETROLOGICA ET MINERALOGICA is sponsored jointly by the Commission on Lithology and Commission on Mineralogy of the GSC, and the Institute of Geology, CAGS. It started publication in 1982 and was changed to a bimonthly journal in 2005. *Acta Petrologica et Mineralogica* mainly covers basic theories and applications of branches and disciplines of lithology and mineralogy, as well as innovative and comprehensive research results, and new methods for rock and mineral test and analysis. *Acta Petrologica et Mineralogica* is the source item of a number of index systems and digests in both China and abroad, and is included in various Chinese databases such as the national press index database (natural science and technology), China Geological Literature Database System, China Geological Digest, China Geological Digest (English edition), China Chemistry and Chemical Engineering Digest, CSTPC, CSCD, CAJCED, CSTPD, as well as website CEPS of Taiwan, AJ, BIG, CA, GEOREF and CSA of foreign countries.

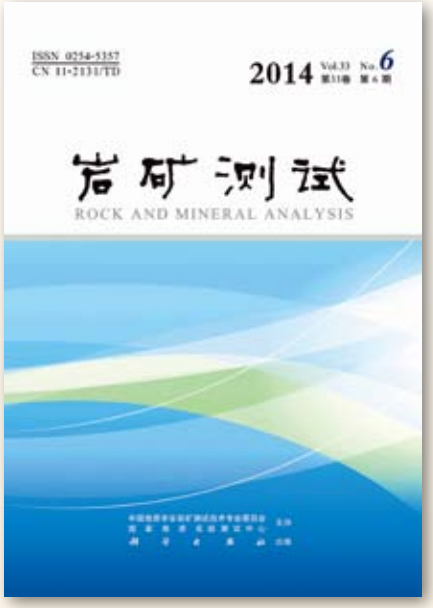


Acta Petrologica Mineralogica published 98 scientific papers (1170 pages) in 2014. Its website had a click rate of over 2.53 million, indicating its high attraction to the geoscientific community. In 2013, the journal had an impact factor of 0.995, the total number of citations of 1157 and a non-self-citing rate of 0.92, showing high rank among the journals of the same scientific field. The journal was again included in the list of the Highest International Impact Academic Journals of China with all the evaluating scores improved over those of 2013.

Website: http:// www.yskw.ac.cn/ch/index.aspx

ROCK AND MINERAL ANALYSIS is sponsored by the Commission on Rock and Mineral Analysis of the GSC and the National Research Center for GeoAnalysis. The journal started publication in 1982. This is the only scientific periodical in China that is related to geoanalysis and reflects the level of geoanalysis of China. All ongoing key research projects of the MST, projects supported by the national foundation, special public-welfare research projects of the MLR, projects related to geological surveys in China, and research projects of all departments of the geological industry in China can be found in this journal.

The quality of published scientific papers of an academic journal is the foundation for raising its competitiveness, the support of the editor-in-chief and experts is a significant factor to improve its academic quality, and the business ability of the editors is key to raising its general quality. In 2014, *ROCK AND MINERAL ANALYSIS* made notable progress in enhancing its academic reference value, overall quality and core competitiveness. Two author training classes were arranged and we adjusted our focus and tried to follow the latest research results and important innovations in analytic and test technologies, so as to raise the academic level of this journal in the literature field.

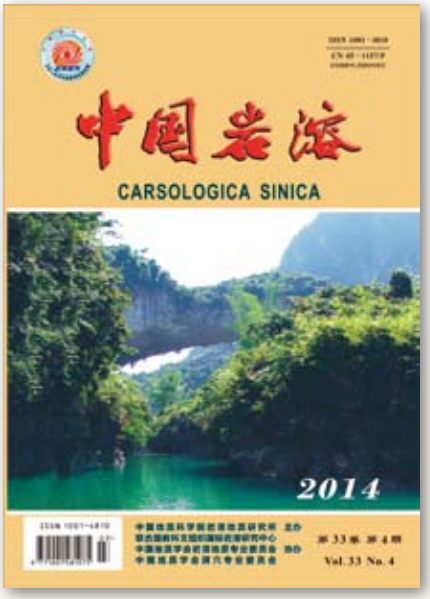


In 2014, 135 papers (908 pages) were published and the click rate of the website was 420,000. The journal had an impact factor of 0.661 and the total number of citations was 1215.

Website: www.ykcs.ac.cn/ykcs/ch/index.aspx

CARSOLOGICA SINICA started publication in 1982 and is a quarterly journal. This is the only academic periodical regarding karst geology published in China. It is sponsored by the CAGS and managed by the Institute of Karst Geology, CAGS, and co-managed by the International Karts Research Center of the UNESCO and the Commission on Karst and Commission on Caves of the GSC. *Carsologica Sinica* has been appraised several times as a fine periodical in Guangxi Zhuang Autonomous Region, and selected as a journal among the "Double-effects Periodicals" in the China Periodical Array,

China's core scientific journals, national Chinese core journals (in 1992 and 2004 editions). It has been indexed or included by a number of world-famous references and databases such as CA, GeoRef and CSA of the US, JST of Japan, IC of Poland, and UIPD, Database Gale and the Library of Congress of the US, as well as CSCD, CSTPCD and CJFD of China.



Carsologica Sinica had four issues in 2014, carrying 64 scientific papers (514 pages). It covered mainly current academic hot topics and difficult problems in the social and economic development in karst areas and showed high academic and application values. The journal had the total number of citations of 671 and an impact factor of 0.570.

Website: http://zgyr.karst.ac.cn/ch/index.aspx

JOURNAL of GEOMECHAMICS is an academic journal sponsored by the Institute of Geomechanics, CAGS and was initiated in 1995. The journal serves as a window to reflect research achievements in geomechanics with the aim of carrying forward Li Siguang's academic thought and pursuing reality, innovation and development. *Journal of Geomechanics* mainly covers the trends and results of cutting edge and theoretical research in crustal movement, continental geological tectonics and dynamic mechanisms, as well as exploration of mineral resources, investigation and prevention of geological hazards, and policies of environmental changes. It is a source periodical for the statistics of Chinese scientific and technological papers, a source item of the comprehensive evaluation database of Chinese academic journals, the Chinese Citation Database of Scientific and Technological Papers, and CAJCED of the CNKI; and is included in the Digital Periodicals of Wanfang Data, CSTPD, Chinese Core Periodicals (Evaluation) Database and CJFD of the CNKI. Altogether 46 research papers (474 pages) were published in 2014. The electronic version of the journal was available, and the full texts can be reviewed free and downloaded on its website. The citation rate and influence of this journal are increasing year by year. The impact factor was 0.788 and the total number of citations was 451 in 2013.

Website: http://journal.geomech.ac.cn/ch/index.aspx

JOURNAL OF GROUNDWATER SCIENCE AND ENGINEERING (English edition), supported by the Institute of Hydrological and Environmental Geology, CAGS, is an integrated academic periodical

of natural science. It started publication in April 2013, quarterly. The journal receives all high-quality manuscripts regarding the following research fields: hydrogeology, environment geology, groundwater resource, agriculture and groundwater, groundwater resource and ecology, groundwater and geological environment, groundwater recycling, groundwater pollution, exploitation and utilization of groundwater, standard methods of hydrogeology, information science of groundwater, and climate changes and groundwater. In 2014, the journal published 48 research papers (404 pages) and was chosen as a periodical in the GeoRef, indicating that the level of hydrogeological research in China is internationally recognized.

Website: http://gwse.iheg.org.cn