2013 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 2013, 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 2013.

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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Preface

Our 2013 annual report concludes this year's scientific and technical accomplishments at the Chinese Academy of Geological Sciences. We have made breakthroughs in mineral exploration and notable progress in environmental assessment researches. Conditions for advancement in the work of science and technology were markedly improved and innovative research led to advances in geological science and technology. Implementation of the research experimental platforms and the scientific research infrastructures proceeded smoothly. Our outstanding human capital is dedicated to sustaining the Academy's compelling mission to advance geological science and technology.

Several areas merit special mention in this annual report.

First is the area of scientific research and geological surveys. Altogether 1022 projects of various types were carried out with a total expenditure of 1.007 billion yuan in 2013, of which 244 million yuan came from support for national science and technology projects, 671 million yuan came from the China Geological Survey (CGS), and 92 million yuan came from other funding sources. In 2013, 958 scientific papers were published, including 225 SCI-indexed papers and 81 EI-indexed papers plus 446 papers presented in the core journals of China. Last but not least, 21 monographs were published.

In 2013, 11 projects were awarded National Invention Patents, 23 received National Patents for Utility Models and 13 were awarded with software copyrights. Researchers of the Academy received 1 first prize of the National Award for Science and Technology Progress (jointly with other research institutions), 2 first prizes and 10 second prizes of the Science and Technology Award from the Ministry of Land and Resources (MLR), 2 provincial and ministerial prizes, 5 first prizes and 10 second prizes of the Achievement Award issued by the CGS. Five research achievements were reviewed as the Top 10 Geological Scientific and Technological Advances by the Geological Society of China (GSC) and 5 projects awarded as the Top 10 Advances by the CGS.

The new findings in 2013 include the recognition of a new mineral of boron nitride, *qingsongite* (nominated by the Commission on New Minerals and Mineral Names of the IMA), and the discoveries of basal therizinosaurus dinosaur and Jurassic multituberculate mammal fossils. Some of these discoveries have been published in international scientific journals such as *Nature* and *Science*.

The second area worthy of mention is science and technology infrastructure improvements. We made major progress in key science and technology projects, fundamental geological research, study of metallogenic and ore-exploration theories, and research and development of new techniques and equipment. The SinoProbe program (deep exploration in China) accomplished deep seismic reflection profiles along a cumulative length of 6166 km, collected enormous high quality observation data sets of

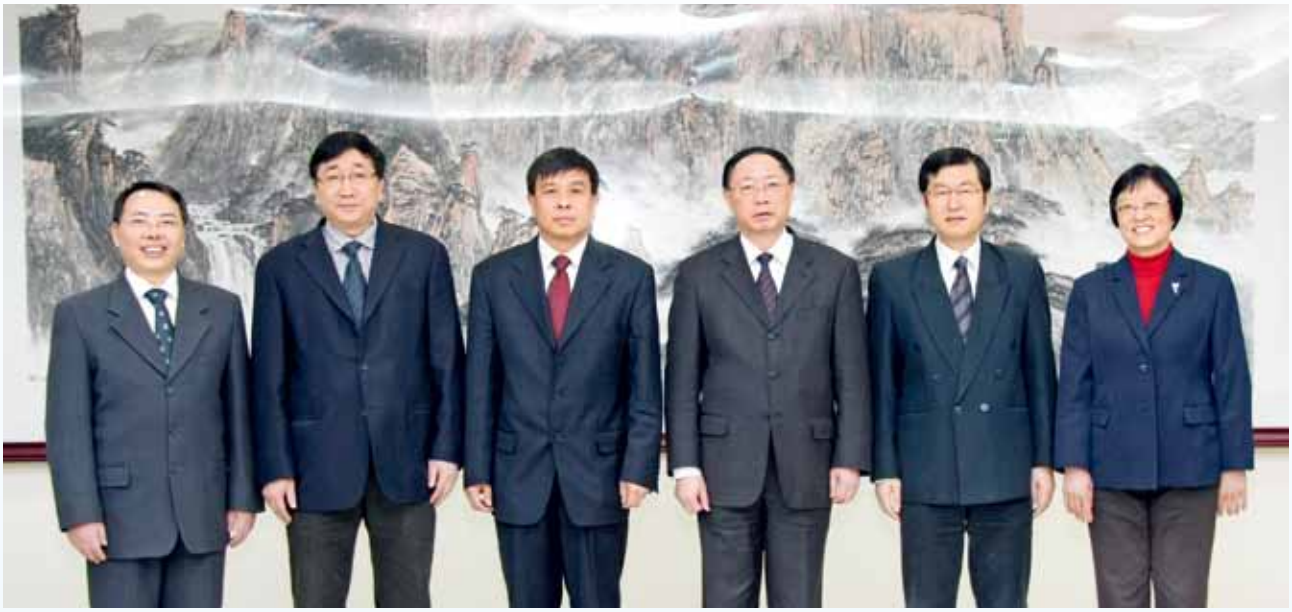
various geophysical fields (such as magnetotellurics, broadband seismic, strain and stress measurements etc.), and conducted geochemical reference network measurements covering the entire continent of China for the first time with the spatial distribution of 78 elements within bed rocks and sediments. The 1∶5M scale Geological Map of Asia (IGMA5000) and the 1∶8M Groundwater System Map of Asia were published in both Chinese and English.

A metallogenic model, known as "five stories+basement", for the Nanling metallogenic belt has been verified by deep drilling. New metallogenic models were proposed for Gangdise porphyry copper and molybdenum ore deposits, potash salt resources and the Jinding super-large lead and zinc deposit in Yunnan. A new model was proposed for nationwide exploration of potash salt deposits. Strategic exploration for "three rare" resources made major breakthroughs while the researchers were exploring for spodumene in the surroundings of Gyabjeka in Sichuan Province. Advances in science and technology played a critical role in making significant breakthroughs in the exploration of such ore deposits as the super-large epithermal Cu-Au deposit in the Duolong mineralizing district in Tibet and the Duocaima lead-zinc deposit in Qinghai.

Substantial advances were achieved in development of new technologies and methods for exploration of natural and mineral resources, including the independently-developed UAV magnetic/radioactive survey system, sap radio CT system, seismic exploration method for metallic ore deposits, new high-pressure sample preparation technique, multistage-driving ore-dissolution technique, artificial groundwater recharge technique and Re-Os isotopic dating analysis.

The third area worth mention is human resources and career recognition. The ongoing challenges of the Academy's mission require a research team with exceptional talents and many technical professionals. The many awards and honors received by the Academy members are a recognition of their expertise and reflect the impact of their contributions to national interests.

One scientist was rewarded as the leading young talented researcher in scientific and technological innovation by the Ministry of Science and Technology (MST); 1 was chosen as a researcher of the National Program for recruiting 1000 oversea top-notch specialists; 2 were chosen by the National Program for Nurturing and Attracting 100-1000-10000 Talents; 11 scientists were selected as the leading talents in science and technology of the MLR; 13 were selected as outstanding youths and 9 research groups were named as scientific and technological innovation teams by the MLR; 8 scientists were selected into the Training Program of High-level Professionals and 10 into the Training Program of Talented Young Geologists of the CGS. One scientist was awarded a title of Honorary Fellow of the Geological Society of America, 5 gained the 14th Young Scientists Award of Geological Science and Technology issued by the GSC and 1 researcher won the 9th Annual Award for Youths Engaged in Geological Work on the Qinghai-Tibet Plateau. The graduate education of the Academy produced significant numbers of talented graduates pursuing careers in academia, universities and industries.



Wang Xiaolie (3rd R), member of Leading Group of the CGS, Vice President of the CAGS; Zhu Lixin (3rd L), Executive Vice President; Dong Shuwen (2nd R) and Wang Ruijiang (2nd L), both Vice Presidents of the CAGS; Wang Jie (1st R), Secretary of the Committee for Discipline Inspection; Wu Zhenhan (1st L), Vice President of the CAGS

The fourth area of note is progress in establishing scientific and technical research platforms. The State key Laboratory of Continental Tectonics and Dynamics was reviewed and approved by the MLR; the National Center for International Research on Karst Dynamic System and Global Change was designated as a National-level international research center by the MST; National Research Center for Modern Geological Exploration Engineering Technology was appraised as a research center of superior class by the MST. Two new ministerial experimental popular science bases were established, 5 ministry-level key laboratories were approved and 10 professional centers went into operation. Nine key laboratories affiliated with the CAGS were newly established, including the key Laboratory of 3D Exploration for Ore District jointly developed by the CAGS and Hefei University of Technology. A shared network of large scientific instruments and equipment was put into operation; the feasibility report on the construction of the geological experimental base for the Academy passed the evaluation by the Investment Center of the National Development and Reform Commission (NDRC) and the project of the International Research Center on Karst was approved by the NDRC. The Academy's video conference system was completed and a series of geologic databases were built and updated.

The influence of the scientific journals sponsored by the CAGS increased. *Acta Geoscientica Sinica* was for the first time indexed by EI. *Acta Geologica Sinica, Geological Review, Mineral Deposits, Acta Geoscientica Sinica* and *Acta Petrologica et Mineralogica* were chosen as journals among the list of the

Highest International Impact Academic Journals of China in 2013.

The year of 2014 is for the Academy to take full advantage of exciting scientific and technical opportunities, to address ever-evolving national challenges in natural resources, geological hazards and environment in support of rapid social and economic development and sustainability. With the focus of target projects, we will meet our vital objectives to make breakthroughs in exploration of natural resources, and basic geological science and technology, while building the Academy into a world-class research institution in earth sciences.

Wang Xiaolie
Member of Leading Group of the CGS, Vice President

Zhu Lixin,
Executive Vice President

Dong Shuwen
Vice President

Wang Ruijiang
Vice President

Wang Jie
Secretary of the Committee for Discipline Inspection

Wu Zhenhan
Vice President

CONTENTS

Chapter I General Development

1 Pilot Program of Scientific and Technological Innovation

A pilot program of scientific and technical innovation has been recommended to be conducted in the CAGS in 2013, by the CGS and Ministry of Land and Resources of China, as a directive from the Minister Jiang Daming. The year of 2014 is designated as the "year of scientific and technological innovation" of the CAGS. Through this planned pilot program, we hope to establish systematical methods and mechanisms for innovative research in geological science and technology.

2 Innovation through Collaboration

To implement collaborative innovation, the CAGS and the Tibet Bureau of Geological Exploration & Mineral Development signed a strategic cooperation agreement, held a seminar on making breakthroughs in mineral exploration in Tibet and decided to jointly establish the Tibet Branch of the CAGS and the Lhasa post-doctoral research program; the CAGS and the Yiyang Group signed a strategic cooperation agreement to jointly establish the Engineering Technical Center for Multipurpose Utilization of Tailing Resources, and further to build a platform to conduct joint research and application developments among enterprises, universities, and research institutions.

3 Management and Operations

We revised the method for evaluating performance of the employees in science and technology innovation in the affiliated organizations of the Academy and amended the evaluation standards for professional qualification of the personnel in scientific research series, finished several documents for management and operations such as "Method for Construction and Administration of Key Labs", "Regulations on the Evaluation of Key Labs" and "Method for Selecting Ten Major Science and Technology Advances", and started a sharing program for large scientific instruments and facilities within the Academy-affiliated research organizations. We also studied management and operational models for research projects in geological surveying.

4 Public Service

Firstly, we provided services to meet needs of local governments and institutions. In 2013, we

organized and provided our expertise and services to Hezheng County, Gansu Province for preserving paleontological fossils, and further communicated and facilitated the joint establishment of the Linxia Research Center for Paleontological Fossils and Geological Relics.

We promoted comprehensive utilization of tailings, carried out evaluation of pollution risks in reservoir areas and provided scientific consulting services on rehabilitation of ecological environments in wetlands and on construction of ecological civilization in Fuping County, Shaanxi Province.

Secondly, we participated in the program for alleviating poverty parted with local governments. We studied major issues in Yanjin County, Yunnan Province, and drafted and implemented relevant plans for reducing local poverty.

Thirdly, we provided excellent services to exploration and mining industries to address their needs through supporting a wide range of activities in geological science and technology meetings, training and outreach, and laboratory services to analyze chemical composition, for example, tungsten and tin ores.

Fourthly, we organized service programs for relief of earthquake disaster and other geological hazards. We provided such an emergency service to the Lushan earthquake region in Sichuan Province, through conducting scientific investigation and identifying geological hazards, and conducting synthetic crustal stress monitoring and seismic-geophysical observations in earthquake regions.

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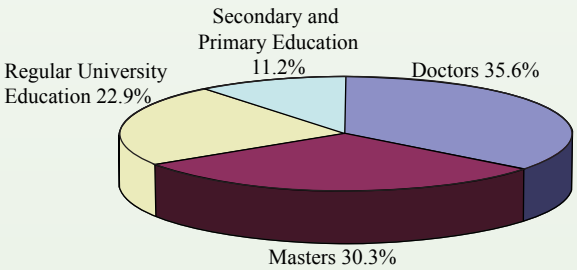
A scientific investigating team from the CAGS worked in the Lushan *M*s 7.0 earthquake-hit region in Ya'an, Sichuan Province on April 24, 2013

Chapter II Human Resources and Finance

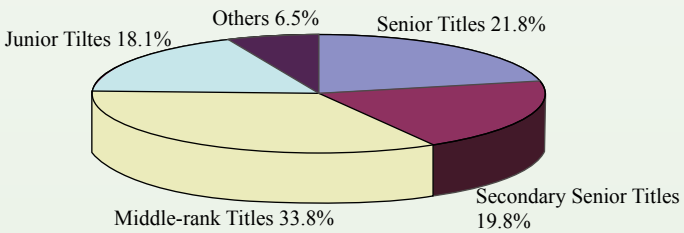
1 Human Resources

The personnel at the Academy consist of permanent employees (serving and retired) and non-permanent employees. Among 2753 permanent positions, 1000 are for not-for-profit public research. By the end of 2013, the actual number of staff was 3558, including 1865 full-time, and 1693 retired. Among those who are full-time, 1025 hold post-graduate degrees (517 with PhDs), and 1452 have technical training education. 604 hold senior professional titles, including 14 Academicians of the Chinese Academy of Science and Chinese Academy of Engineering.

Exceptional performance and expertise were recognized with awards and honors received by Academy personnel. 34 special government allowances of the state council, 7 were awarded the title of National Outstanding Young and Middle-aged Specialists with Significant Contributions, 1 researcher awarded a leading young scientist in science and technology innovation by the Promotion Program for Innovation Professionals of the MST, 1 chosen by the National Program for recruiting 1000 overseas top-notch specialists, and 2 scientists by the National Program for Nurturing and Attracting 100-1000-10000 Talents; 28 scientists were selected to be included among the top 100 science and technology innovative talents of the MLR; nine research groups were named as 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.



Distribution of Education Levels of Professionals



Distribution of Technical Titles of Professionals

2 Annual Expenditures

In 2013, the actual expenditures were 1.84 billion yuan, with a 7.9% increase over 2012. The academy further invested in infrastructure through purchases of 34 large facilities, with each costing more than 500,000 RMB, to significantly enhance accessibility to high-precision/accuracy tools at the CAGS.

Chapter III Research Institutions and Major Scientific and Technological Achievements

The Chinese Academy of Geological Sciences consists of its headquarters, and seven institutes and is a non-profit public geological research organization, administrated by the CGS, Ministry of Land and Resources.

The Academy is a core component of the national research body for innovation in science and technology. Its major mission is to conduct fundamental researches in geological science, to undertake geological surveys to address urgent national issues in natural resources, earthquakes and geological hazards.

The seven research institutes include the Institute of Geology, the Institute of Mineral Resources, the Institute of Geomechanics, the Institute of Geophysical and Geochemical Exploration, the Institute of Hydrological and Environmental Geology, the Institute of Karst Geology and the National Research Center for GeoAnalysis.

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.

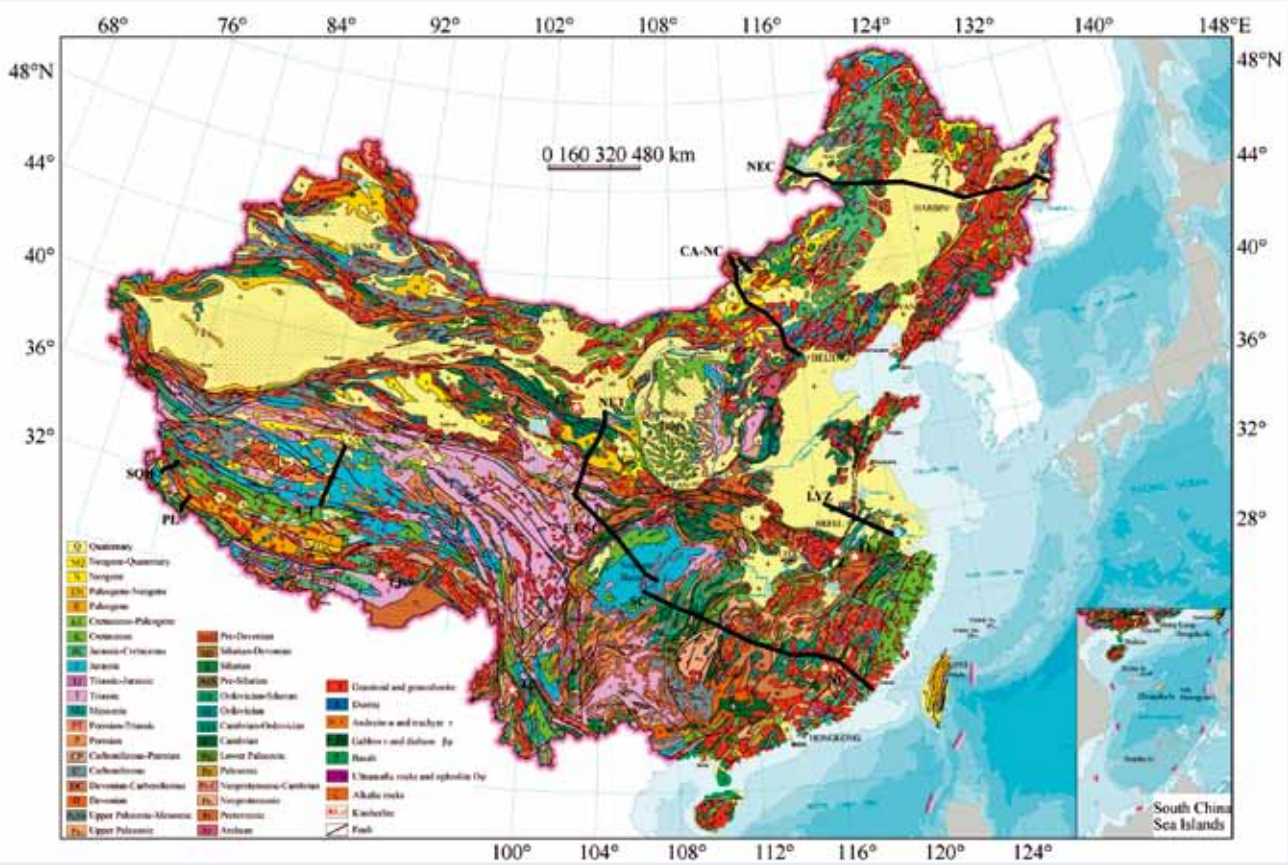
CAGS Headquarters

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 Employees 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 SinoProbe project has completed four long seismic reflection profiling lines with an accumulated total length of about 6160 km, crossing major orogens such as Qinghai-Tibet Plateau and South China and major oil-gas-bearing basins, to reveal the deep crustal features of the Chinese continent. The 10000-meter drilling rig "Crust No.1" was transported to Heilongjiang Province to start a drilling project of SinoProbe in the Songliao Basin, reflecting a new breakthrough in the independent development of major equipment technologies in China. The achievements of the SinoProbe were reported in meetings of the European Geosciences Union and International Mining Congress, American Geophysical Union and published in a number of renowned international academic journals, thus having attracted vast international attention and interest. The research team prepared for submitting a proposal for a national key infrastructure project and completed the fifth revised version of the proposal.



A sketch showing the localities of the major deep seismic reflection profiles and the continental drilling hole completed during 2008-2013 in the special research project SinoProbe

Institute of Geology, CAGS

The Institute of Geology is dedicated to fundamental, strategic and pioneering geological surveys and researches, and undertakes the task of training professionals in geology, geophysics and geochemistry.

Major Research Achievements:

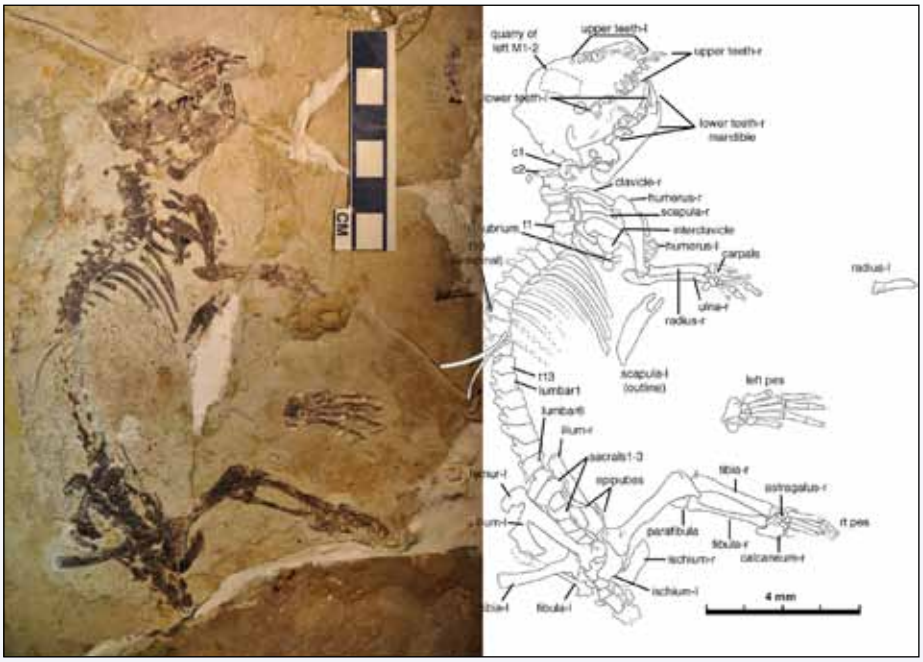
(1) New versions of geological maps: The 1∶5M International geological Map of Asia (IGMA5000) was published and over 30 basic geological maps were compiled, including the 1∶5M Distribution Map of Tectonics and Coal-bearing Basins of China, 1∶5M Plate Tectonic Map of Early Paleozoic China, 1∶12M Lithofacies Paleogeographic Map of Major Hydrocarbon-bearing Strata of China, 1∶12M Distribution Map of Hydrocarbon Source Rocks and Reservoirs of Main Oil and Gas Basins of China.

(2) New advances in research of orogeny and metallogeny in the Qinghai-Tibet Plateau and adjacent areas: Many new lines of evidence have been found for the hypothesis that *the Qinghai-Tibet Plateau is an orogenic plateau comprised of huge orogenic amalgamated bodies*. The research group expounded on and proved a deep-mantle genesis of ophiolite and proposed a new type of diamond, namely "ophiolite diamond", and a model for its deep-mantle dynamics. The research revealed five events which the basement of the southeastern Qinghai-Tibet Plateau had experienced, established a 3-D dynamic pattern for High Himalaya and put forward a new escape mechanism of "drawer-like detachment-transform" for the formation of the southeastern margin of the Qinghai-Tibet Plateau during the period from the middle Paleocene to the early Miocene. The research group overcame numerous bottlenecks in use of probing techniques and detected strong indicative information from the Moho in extremely thick crust in the hinterland of the Qinghai-Tibet Plateau.

(3) Serial results in the study of the Tianshan-Xingmeng orogen: A new scheme of classification was proposed for tectonic components in the crust of this area, and structural attributes of the Alxa-Dunhuang block were addressed. Based on continental evolution and cycle, the Crustal Framework and Structural Division Map of Northern China and Adjacent Areas were compiled and the Mesozoic Granite Map of Asia was completed.

(4) Breakthroughs in stratigraphic and paleontological study: A multituberculate mammal fossil was discovered and the result published in Science. A new dinosaur fossil, basal Therizinosaurus, was found and reported in *PLOS ONE*. Fossil Oviraptorosaurs, the smallest ever known dinosaur, was discovered and the finding was published in *Nature*.

(5) New advances in application of isotopic technique and development of reference material: Distribution characteristics of iron isotopes in different layers of the crust and from major rock types were documented and a reference system for tracing iron isotopes was established; Some geological and geochemical interpretation and analyses of iron isotopes



Rugosodon eurasiaticus holotype

were conducted for some representative ore deposits, and a theoretical model was proposed for tracing of iron mineralization by means of iron isotopes. Neodymium isotope reference material was developed and an application was made to acknowledge this material as a national first-class reference material.

(6) Research results in mineralogy and ore prospecting: A new mineral, boron nitride (qingsongite), was discovered; primary siderite was found in Jixian County, Hebei Province and coexistence of both high-Cr and high-Al chromite bodies in the Purang intrusion was reported for the first time in the western Yarlung Zangbo suture zone in Tibet. Under the guidance of the research group, a discovery was made in the exploration of the Duocaima Pb-Zn ore deposit in Qinghai Province. The pattern of ore occurrence was ascertained based on structural lithofacies mapping and the orebodies were located through audio telluric sounding. A proposal for a drilling program for this ore deposit was put forward. The resources of lead and zinc in this ore block were revised upward from the original 760,000 tons to the revised estimate of 2.59 million tons, for an increase of 1.83 million tons.

(7) Seismic records of the third nuclear test of Korea were detected with the multi-depth seismic monitoring equipment at the observatory of crustal movement of the East China Sea.

Institute of Mineral Resources, CAGS

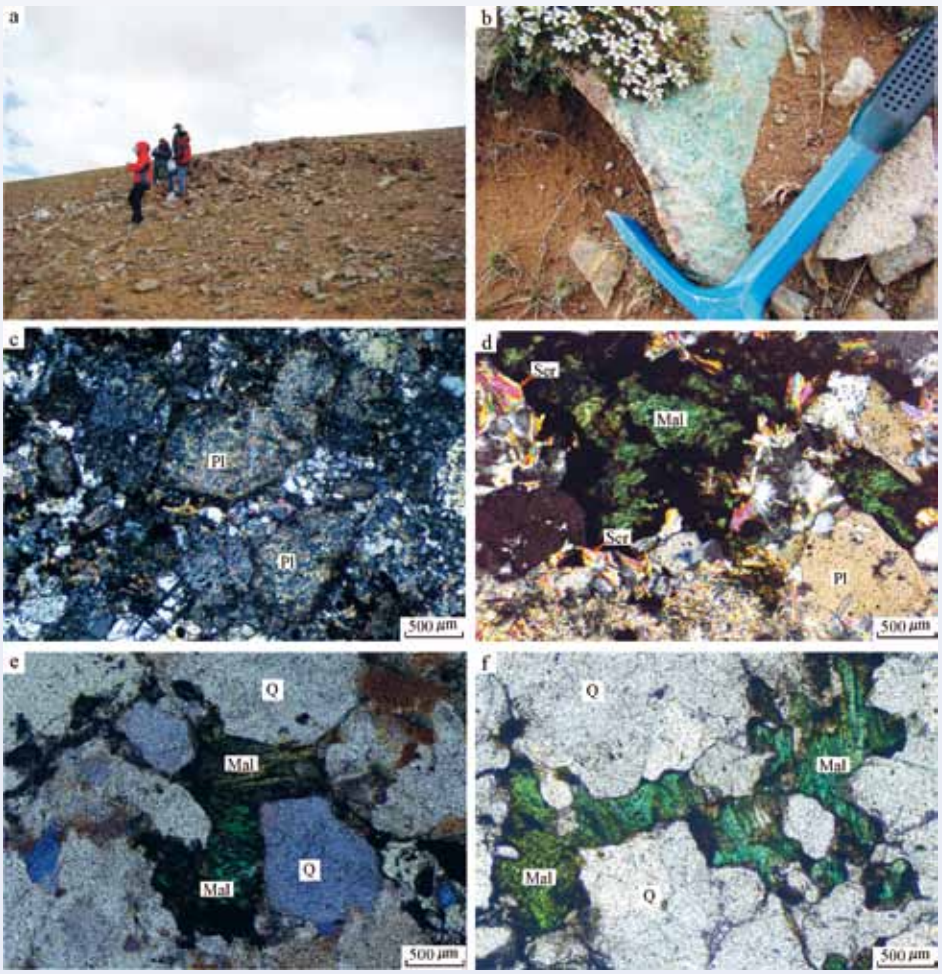
The Institute of Mineral Resources, as the only public institution focusing on research on mineral resources in China, undertakes mainly the following tasks: conducting research of regional metallogenic models and new theories and methods of mineral exploration; investigation and assessment of potential

mineral resources and prospective evaluation; solving major scientific problems relevant to mineral resources and carrying out geological survey to provide theoretical and technological support to mineral prospecting of the country.

Major Research Achievements:

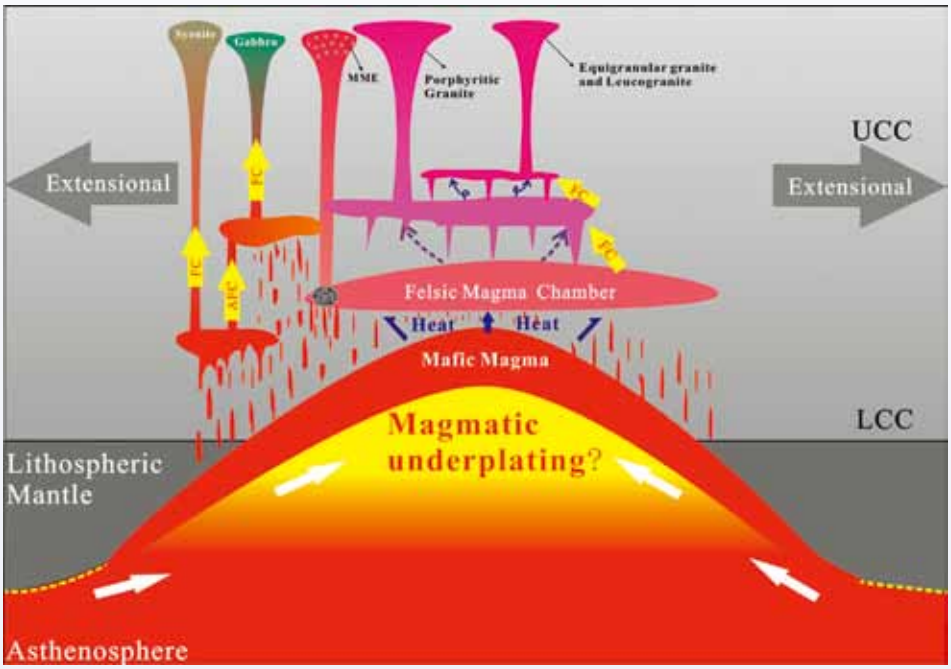
(1) Marine fossils discovered in the upper part of the Late Permian Linxi Formation in the Xingmeng area: The study shows that the Xingmeng area in Inner Mongolia had a marine or primarily marine sedimentary environment even until the Late Permian. This finding gives new and reliable evidence for identifying the eventual close of the Xingmeng sea basin and would facilitate adjustment of the thoughts and deployment of exploration for ordinary oil-gas, shale gas (oil) and other metallic and nonmetallic ores in Late Permian strata in the Xingmeng area.

(2) A discovery in ore prospecting: The Xiongmei porphyry copper deposit was found in the Bangong-Nujiang suture zone in Tibet, which has potential to become a large-sized ore deposit. This could promote our understanding for mineral exploration in the Tibet area.



Outcrop and Cu mineralization of ore-bearing porphyry of the Xiongmei copper deposit

(3) New understanding regarding the super-large Gejiu Sn-Cu polymetallic deposit in Yunnan: Research revealed that mineralization and contemporaneous magmatism bear a close genetic relationship in the concentrated area of tin-polymetallic deposits in the study area. This deposit was considered to have a magmatic-hydrothermal genesis rather than syngenesis.



A diagram showing the deep background and process of the Late Cretaceous diagenesis and metallogenesis in the western part of South China

(4) Metallogenic process of W-Mo-Cu deposits related to Caledonian granodiorite-porphyry in the Dayaoshan area: The study pointed out that there occur a series of porphyry-skarn-quarte vein type W-Mo-Cu ore deposits related to Caledonian granodiorite-porphyry in the Dayaoshan area in Guangxi.

Institute of Geomechanics, CAGS

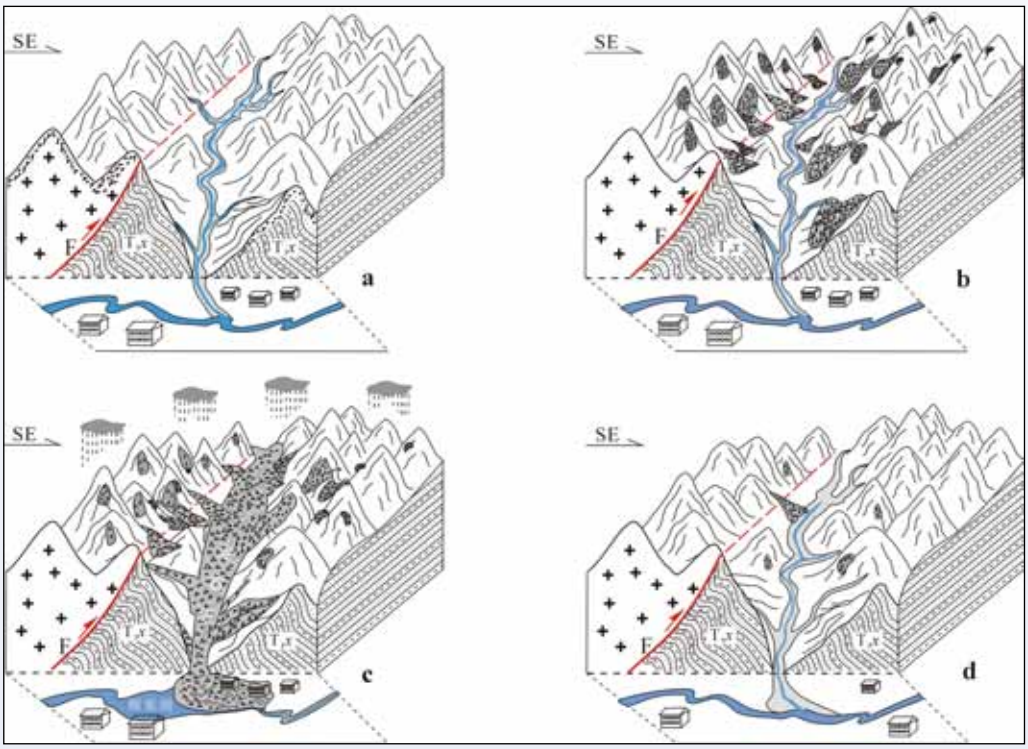
The Institute of Geomechanics was founded by Prof. Li Siguang, a distinguished geologist of China, and was dedicated to research in such directions as basic geology, crustal stress and stability, mineral and energy resources geology, Quaternary geology and environment, geological hazards, neotectonics and mobile structure and polar geology.

Major Research Achievements

(1) Age, metamorphic process and tectonic implications of the granulitized basic dike swarm in the Vestfold Hills in East Antarctica: The study revealed that mafic dykes have experienced

inhomogeneous granulitization, which implies that the Vestfold landmass has been involved into the Rener collision-orogenic process resulting in the convergence of the India craton and East Antarctica, which is similar to Archean landmasses such as the Napier complex, Rauier Group and Lambert terrane. This is of great significance for reconstructing tectonic evolution of the eastern Antarctic continent during the Grenville Stage and reconstructing the supercontinent.

(2) Formation mechanisms of large-scale landslides in active structural belts: The study argued that convergence areas of regional active faults are structural positions prone to large and even huge landslides, and proposed that a seismic landslide usually witnesses five stages in its formation and evolution. A model was then built for the formation of geological hazards, which can serve as an important guide for early recognition of geological hazards.

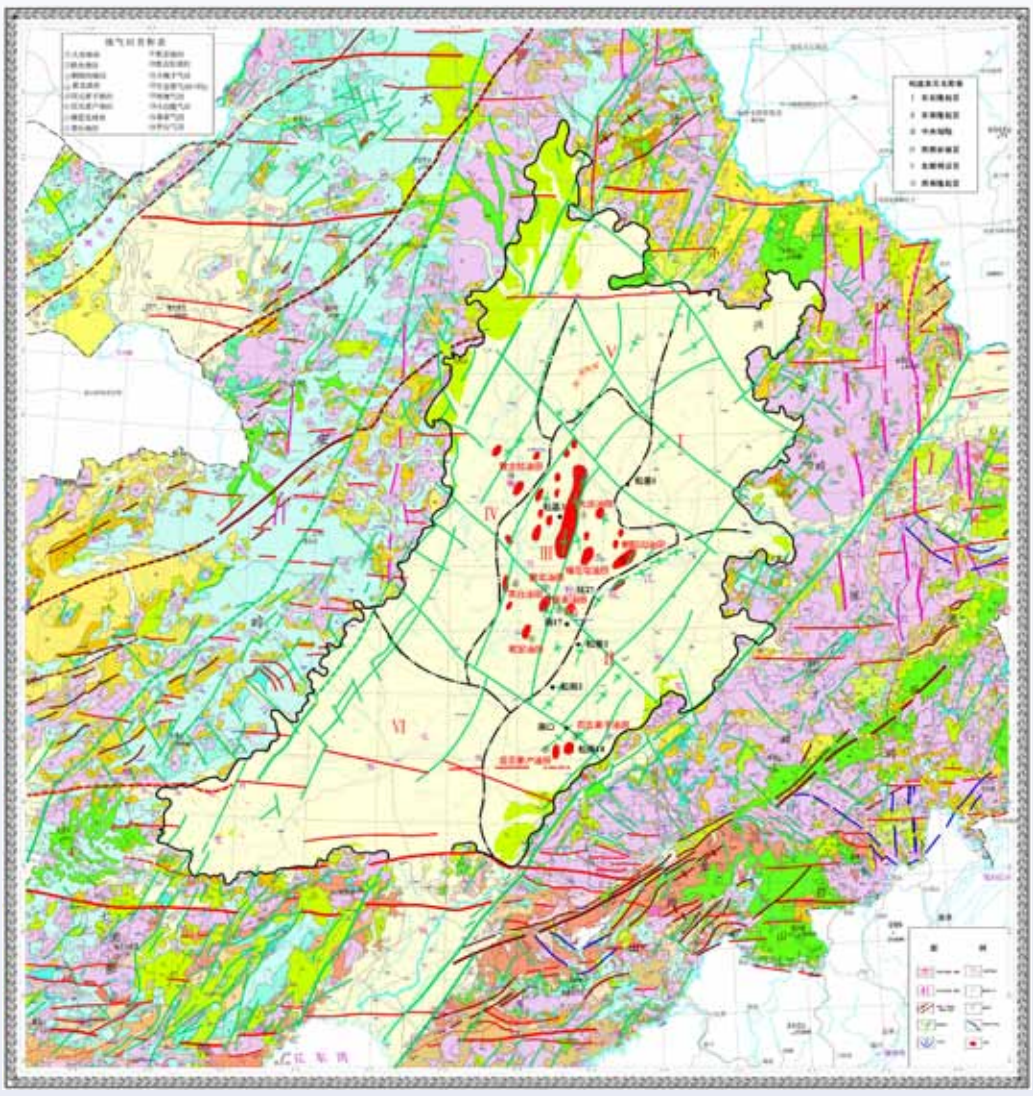


An earthquake-landslide-debris flow hazard chain

(3) Oil-gas-reduction metallogenesis of the Wulagen lead-zinc deposit in Xinjiang: A metallogenic model was proposed for this lead-zinc deposit: the ore deposit was formed when ore-forming materials such as Pb and Zn precipitated and cumulated in oil-gas reduction process while Pb-Zn-rich fluids flowed through highly permeable sandy conglomerates of primary oxidation state.

(4) Structural systems for controlling oil in eastern-central China: The study for the first time made a systematic classification of the structural systems in the Song-Liao area (latitudinal structural system,

Cathaysian structural system, Neocathaysian structural system, longitudinal structural system and epsilon-type structural system); restored the Song-Liao prototype basin since the Paleozoic under the control of tectonics (Cambrian-Ordovician: rift-craton basins; Silurian-Devonian: quasicratonic basins; Carboniferous-Permian: intracraton depression basins; Meso-cenozoic: fault-depression basins).



The map of structural system in the Song-Liao Basin and adjacent regions

Institute of Hydrogeology and Environmental Geology, CAGS

The Institute of Hydrology and Environmental Geology is the only national public research institution focusing on addressing theoretical and technical challenges in hydrogeology, engineering geology and environmental geology in support of nationwide hydrogeological survey and groundwater resources assessments. The institute is also an exclusive compilation center of various hydrological and environmental geological maps.

Journal of Groundwater Science and Engineering (English edition) was initiated in 2013 by this Institute.

Journal of Groundwater Science and Engineering (English edition)

Major Research Achievements:

(1) Investigation and assessment of nationwide groundwater resources and environment: The following atlas and maps were completed: Atlas of Groundwater Resources and Environment of the Major Basins in Northern China, Distribution Map of Major Aquifers in China, Groundwater Resources Map of Asia (1:8M) and Groundwater Environmental Background Map of Asia (1:8M). Evaluation was conducted for geological storage potential and prospective regions of CO_2.

(2) Evaluation of the present situation and regionalization of geothermal resources of China: A regionalization scheme of adoptability for the development and utilization of shallow geothermal energy

Map showing the geological environment for groundwater exploitation and utilization in Asia

was conducted. Consequently, favorable regions of exploration for hot dry rock resources of China were located and comprehensive assessment methods for geothermal resources in different types of sedimentary basins were proposed.

(3) Geological investigation of hydrogeological environments of the major energy bases: Over 20 prospective water supply places were determined in five energy bases, and 39 drilling holes were completed for both water exploration and exploitation with the total water yield of 33600 m^3/d, so that the water shortage of mining districts could be well alleviated. Three Tertiary sandstone fissure water wells were successfully dug beneath perennial frost layers.

(4) Investigation and assessment of groundwater pollution in western-central China: Real-time monitoring-controlling and management system of test quality of groundwater samples was independently developed and the simulation platform MODFLOW/MT3DMS was built, which acquired

an independent intellectual properties right.

(5) Investigation and assessment of geological environment of city swarms in the Zhongyuan-South-Central Hebei area: Detailed classification of Quaternary strata in Zhengzhou and Kaifeng cities was carried out for the first time. Water-rich places and reserve groundwater sources in Luoyang City were located. A related database and 3D visualization system were developed and the assessment method of geological adoptability in utilizing underground space was created.

(6) Evolution Mechanism and Control of Groundwater in the North China Plain: Under the auspices of Project 973 (National Program in Science and Technology), the research group reconstructed the evolution characteristics of the hydrodynamic field in the North China Plain during the past 60 years, identified the response of the hydrodynamic field to human activities and natural variations; critical identifying indicators of groundwater crisis were built, and control measures for easing crisis of groundwater in the North China Plain were proposed, which provided significant scientific and technological supports for alleviating water resources shortage in the North China Plain.

(7) Study of the Strategy for development and utilization of geothermal resources of China: This is a major consulting project of the Chinese Academy of Engineering. As a result of the research project, high-temperature geothermal regions (fields) which are prospective in development and utilization were located initially and geothermal distribution and patterns of heat reservoirs of all key geothermal regions (fields) were analyzed. The project set up the fundamental base for further research regarding the scales and prospective layouts of geothermal power generation.

(8) Groundwater recharge technique and demonstration in typical regions in the North China Plain: This is a special public professional project of the CGS. This research project built a basic high-efficiency groundwater recharge system, designed a 3D groundwater recharge model and established a demonstration project of groundwater recharge.

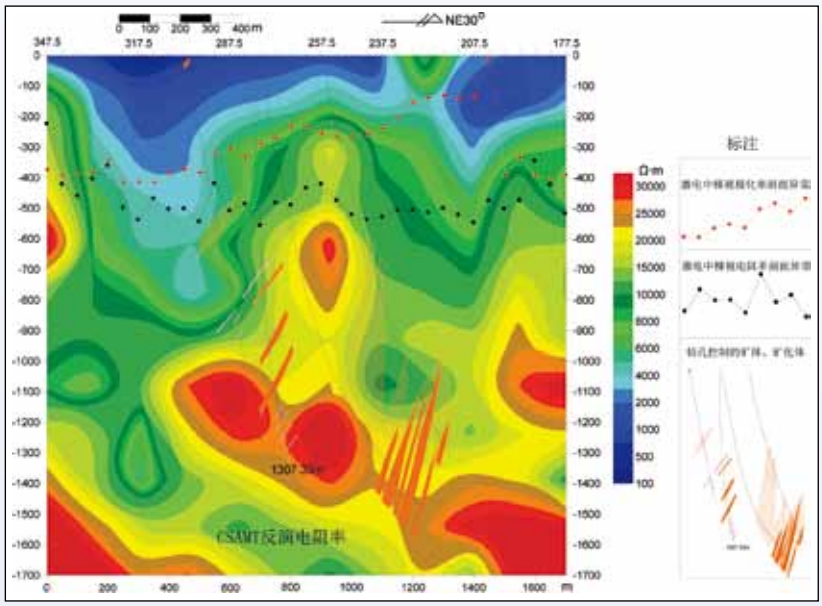
Institute of Geophysical and Geochemical Exploration, CAGS

The Institute of Geophysical and Geochemical Exploration is a scientific innovation base of the national geological exploration industry, dedicated to the tasks of conducting research and development in prospecting geophysics and prospecting geochemistry and promoting technological progress in related research fields, and undertaking national basic, public-benefit-oriented and strategic geological surveys. The institute has been playing the role of a hub for R&D of theories and new methods and techniques in geophysics and geochemistry and for transforming scientific research into practical industrial usage.

Major Research Achievements:

(1) Application and promotion of high-power multi-functional electromagnetic system and multi-frequency array phase IP system: Clear IP and CSAMT anomalies were obtained by adopting the

domestic multi-functional electromagnetic measuring system in the lead-zinc mining area in Xiyi Village, Baoshan City, Yunnan Province, where the metallogenic geological background and tectonics are complicated in addition to humanity's electromagnetic noises and carbon disturbance. These anomalies indicate deep prospecting potential and are of important guiding significance for further ore prospecting in this area. The controlled-source CSAMT yielded good results in the copper mining area in the Duobaoshan Town. Not only characteristics of the copper orebody at a depth of 1300 m was revealed, but also new clear prospecting targets were discovered at deeper layers and on the sides of the known ore.



Compound interpretive diagram of electrical survey in the Duobaoshan Copper Deposit, Heilongjiang Province

(2) Development and application demonstration of measuring technique of UAV-based airborne geophysical prospecting (airborne electromagnetic/ airborne magnetic/airborne radioactive) system: The world's first prototype of comprehensive UAV-based airborne geophysical prospecting measurement system (airborne magnetic/airborne radioactive) was developed and its application testing was carried out successfully. Core technologies such as aerodynamic configuration, electromagnetic compatibility, telemetry and telecontrol were developed.

CH-3 UAV-based Airborne Geophysical Prospecting (airborne magnetic/airborne radioactive) Integrated Station
"航放晶体" in the picture stands for Crystal for airborne radioactive survey and "航磁探头" for Sonde for airborne magnetic survey

(3) Development of a high-precision gravity and magnetic instrument and application of high-temperature superconducting technology: Based on the advances in technologies of measuring systems such as quartz spring sensitive components, a prototype of the high-precision gravimeter was developed, which filled in a gap in China. The amplitude-phase instrument was widely applied, so as to make a contribution to the promotion of using new technology.

(4) Development of high-accuracy tri-component borehole magnetometer: The high-accuracy tri-component borehole magnetometer was successfully developed to increase the logging depth to 2,000 m and the measurement accuracy was significantly improved in comparison with the instruments of its type used in China. It can be used in exploration for deep ore bodies with strong and moderate magnetism and will be hopefully commercialized in the future.

(5) Development of small-bore multi-parameter deep logging system and borehole array IP observation system: This is an array borehole-surface and surface-borehole IP observation system and the corresponding 3D data processing and explanation software is also developed.

(6) Demonstration of 3D graphic system of geological mapping in integrated geophysical exploration in major metallogenic belts in the middle and lower reaches of the Yangtze River: The research group developed a visualization system for 3D geological mapping based on 3D geological modeling technique and 3D geological structure rendering function of MapGIS K9.

(7) Integration of regional geophysical survey results, development of geophysical methods and techniques and regional geochemical survey in ore-forming belts: The research groups developed much-needed methods and techniques for regional geophysical and geochemical exploration. They organized and participated in the national regional geophysical survey in ore-forming belts, carried out nationwide regional geochemical reconnaissance program, and compiled basic geophysical maps of major ore-forming areas and belts.

(8) Regional geochemical exploration demonstration of maneuvered drilling in shallow covered areas in the East Tianshan metallogenic belt: A shallow-drilling geochemical system applicable to shallow-covered areas was developed for different exploration levels: investigation, reconnaissance and detailed exploration, which has been effectively applied to various types of shallow-covered areas in Xinjiang, Gansu and Anhui, and located geochemical anomalies of polymetallic or iron-family elements related to bedrock or mineral deposits. It has provided technological support to geochemical prospecting and evaluation of mineral resources in shallow-covered areas of more than 1,500,000 km^2 in China.

A site of geochemical sampling with maneuvered drilling in a shallow covered area

Institute of Karst Geology, CAGS

The Institute of Karst Geology conducts mainly research work of basic theories and application of karst geology, carries out investigation and evaluation of karst (caves) and provides theoretical support and technical services to nationwide geological survey in karst geology.

Major Research Achievements:

(1) Research on regulation and storage technique of water and land in karst peak cluster depressions: This is a research project funded by the scientific support program of the MST. The research team has developed techniques and models for water-land conservation and surface karst water regulation and storage. They integrated the technique for the treatment of rocky desertification and recovery of ecosystem and improved the construction of the Guohua demonstration area in Pingguo County, so that the pitaya ecological industry was extended to more areas in Guangxi. This project received the second prize of the Award for Science and Technology Progress of the Guangxi Zhuang Autonomous Region in 2013.

(2) Research of filling process and mechanism in karst caves near surface (a subject of Project 973): A paleokarst cave filling model of the Tahe Oil Field was built to present evidence for disclosing filling and formation mechanisms of karst cavities. The research gave preliminary explanation for

Representatives from the Guangxi People's Political Consultative Conference visiting the Guohua demonstration area

collapse mechanisms and control factors of the paleokarst caves in the Tahe Oil Field and promoted our understanding on the influence mechanism for the formation of cave elements in the Tahe Oil Field.

(3) Hydrogeological and environmental geological investigation of the Wumeng Mountain area: The research group analyzed the conditions of karst development and water abundance of water-filled systems in the context of geological setting and groundwater distribution pattern of the study area. The total footage of drilling holes for exploration and exploitation was up to 5072 m and 20 wells were completed with the total water yield of 12787 m^3/s, enough for serving 56500 people and 15721 draught animals and for irrigation of 910 acres of farmland.

Villagers of an ethnic minority village in Hezhang County, Guizhou Province presenting a silk banner for appreciation of efforts of water exploration

(4) Investigation of karst carbon sinks in typical river valleys of China: During the investigation, the research group regularly collected samples from the trunk stream and tributaries of the Yangtze River and conducted analyses for waters and carbonic anhydrase activity of soils to find out the distribution of carbonic anhydrase activity and its relationship with carbon sinks. The investigation shows that the solutes in the Yangtze River and tributaries come mainly from weathering of carbonate rock and clastic rock. The CO_2 consumption of weathering is about 22.22 t $CO_2/(km^2 \cdot a)$, and the carbon sink flux of the Wujiang River is 36 t $CO_2/(km^2 \cdot a)$, which is the highest; whereas that of the Gangjiang and Tuojiang rivers is 16 t $(CO_2/km^2 \cdot a)$, which is the lowest.

(5) Supplementary hydrogeological investigation and research of the SICOMINES Copper and Cobalt Mine of Congo (Kinshasa): This is a public service project. In this research, a mathematic model for predicting inflow of water in the mine was established. The research revealed the law, planar distribution and vertical zonation of karst development; summarized types of R2 karst aquifers and considered that the major permeable beds of the mine are intensively-developed karst areas (CMN2 and RSC) and the structural belts affected by rupture zones. The northeastern and southern boundaries of the mine were basically outlined and their features were documented.

National Research Center for GeoAnalysis, CAGS

The National Research Center for GeoAnalysis is a State-level analysis and test center affiliated with the MST. This analytic and research center conducts development of new methods and techniques for geological experiment and test, undertakes analysis and test for difficult and complicated geological and mineral specimens, as well as referee samples. The Center also carries out application and research of geochemical test technology and provides theoretical support in geological experiment and technological services to the national geological survey.

Major Research Achievements:

(1) Research and demonstration application of the modern ICP-AES/ICP-MS in the analysis of ore-forming and associated elements in such important mineralizations as tungsten, iron and copper: The research group has developed new methodologies with the ICP-AES/ICP-MS equipment for tungsten, niobium, tantalum, rare earth, beryllium ore and vanadium ore. This analysis will reduce the detection limits of associated elements in niobium tantalum ore, tungsten ore, beryllium ore, rare earth ore and vanadium-titanium magnetite, and is more convenient, more accurate and faster than traditional methods.

(2) Improvement and test run of the on-site rapid test and detection system

The research group established a real-time monitoring system for gas hydrate drilling mud degassing in permafrost. This system is capable of simultaneous monitoring of both hydrocarbon and non-

hydrocarbon gases. A portable analysis system for gas chromatographic determination of wellhead free gas was basically developed.

(3) Preparation of first-class reference materials in China

In 2013, progress was made in making geological reference materials. The General Administration of Quality Supervision, Inspection and Quarantine of China approved 41 geological reference materials in 9 series, accounting for 10% of the total number of the national existing first-class reference materials in the geological sector. Among these geological reference materials, 18 in 5 series were developed by the National Research Center for GeoAnalysis.

(4) Independent development of the on-site test instrument for shale gas content

In 2013, this research center completed independent development of an on-site gas-bearing shale gas test instrument. This invention received the national utility model patent, and an application for an invention patent was filed. It has been effectively applied to geological survey of shale gas.

In-situ analytic instrument for shale gas

Chapter IV Major Awards for Scientific and Technological Achievements

Project "Development and industrialization of a whole set of exploitation techniques for K_2SO_4 production with the yield of one million and two hundred thousand tones per year in Lop Nur Salt Lake" won the first prize of the National Award for Science and Technology Advance (the CAGS listed as fourth among all the participating institutions).

In 2013, the CAGS won 2 First prizes and 10 Second prizes of the MLR Award for Science and Technology; 2 provincial and ministerial awards and 5 First prizes and 10 Second prizes of the CGS Achievement Award. Five research achievements were chosen among the Top 10 Geological Scientific and Technological Advances by the GSC, and 5 projects among the Top 10 CGS Advances. There were 11 projects attaining the national invention patents, 23 projects acquiring national patents for utility models and 13 projects registered with software copyrights in 2013, which is the highest number of annual awards of patents that has been received by the CAGS in recent years.

MLR Awards for Science and Technology

Ser. No.	Research project	Investigation organizations	Principal investigators	Award
1	Status quo of the Investigation of National Mineral Resources Development	Institute of Mineral Resources, CAGS	Wang Anjian, Wang Ruijiang, Li Houmin, Wang Gaoshang, Wang Yongyi, et al.	First prize
2	3D Lithospheric Structure in China	Institute of Geology, CAGS	Li Tingdong, Yuan Xuecheng, Xiao Qinghui, Huang Zongli, Ye Tianzhu, et al.	First prize
3	Models of Main Metal Deposits of China	Institute of Mineral Resources, CAGS; Tianjin North China Geological Exploration Bureau; Geology and Mineral Exploration Bureau of Hunan Province; Xinda Geology and Mineral Resources New Technology Co., Ltd. of Henan Province	Mao Jingwen, Zhang Zuoheng, Pei Rongfu, et al.	Second prize

Ser. No.	Research project	Investigation organizations	Principal investigators	Award
4	World Metallogenic Map of Large and Superlarge Deposits and Global Metallogenic Regularity	Institute of Mineral Resources, CAGS; China Non-ferrous Metals Resource Geological Survey; Development Research Center of China Geological Survey	Pei Rongfu, Mei Yanxiong, Dai Zixi, et al.	Second prize
5	Groundwater Contamination Investigation and Assessment in the Pearl River Delta Region	Institute of Hydrogeology and Environmental Geology, CAGS; Guangdong Geological Survey Institute	Sun Jichao, Zhi Bingfa, Jing Jihong, et al.	Second prize
6	Rocky Desertification Research and Its Comprehensive Treatment in Guangxi Karst Mountain Area	Institute of Karst Geology, CAGS; Guangxi Institute of Botony, CAS; Institute of Subtropical Agriculture, CAS; Guangxi Technical Development Center for Mountain Areas	Jiang Zhongcheng, Luo Weiqun, Deng Yan, et al.	Second prize
7	Rock and Mineral Analysis (the fourth edition)	National Research Center for GeoAnalysis, Institute of Geophysical and Geochemical Exploration, CAGS; Institute of Mineral Resources, CAGS; Beijing Research Institute of Uranium Geology; Xinjiang Institute of Geology and Mineral Resources; Hebei Province Geological and Mineral Center Laboratory; Institute of Hydrogeology and Environmental Geology, CAGS	Li Jiaxi, He Hongliao, Zhou Jinsheng, et al.	Second prize
8	Landslide Risk Assessment Theory and Technology	Institute of Geomechanics, CAGS	Wu Shuren, Shi Jusong, Wang Tao, etal.	Second prize
9	Study on the Patterns and Forming Mechanism of Fracture-cavity Systems in Ordovician Carbonate	Institute of Karst Geology, CAGS	Xia Riyuan, Zou Shengzhang, Liang Bin, etal.	Second prize
10	Paleogene-Neogene Enviro-nmental Evolution of the Key Paleolakes, Tibet	Institute of Geomechanics, CAGS	Meng Xiangang, Shao Zhaogang, Han Jian'en, etal.	Second prize

1 First Prizes of the MLR Award for Science and Technology

(1) Status quo of the Investigation of National Mineral Resources Development

Principal Investigators: Wang Anjian, Wang Ruijiang, Li Houmin, Wang Gaoshang, Wang Yongyi, Gao Lan, Zhao Ting, Li Jianwu, Chen Qishen, Yu Wenjia, Meng Gang, Li Ruiping, Gao Hui, Zhang Zhaozhi, and Yan Qiang.

PI Organization: Institute of Mineral Resources, CAGS.

Deployed by the MLR in 2007, this program was an investigation of the national status of mineral resources, which is by far the most systematic one in methodology and the largest one in scale. After 5 years' dedicated work of over 30,000 people from 31 provinces (municipalities and autonomous regions) in 25,753 mineral areas with a total expenditure of 2.25 billion yuan, 28 types of commodities were investigated, including oil, gas, uranium, coal, iron, copper, aluminum, rare earths and etc. Through the investigation, great achievements were made. The reserves, constitution, quality, development status and spatial distribution of the mineral resources were clearly summarized. A large amount of resources were rediscovered while false resources were removed. Based on the results of the investigation, many new understandings about China's mineral resources were obtained. In addition, a spatial database of national mineral resources was built and the Supporting System of Dynamic Management of National Reserves was developed, which contributed to the leap of resources and reserves management from one dimension to two and a half dimensions (i.e. from attribute data to spatial data), and formed a platform for the realization of "managing mineral resources with a single map". As a result, a large number of reports and maps were obtained, including 21,540 sets of mineral-area investigation reports, 550 sets of provincial summary reports, 28 sets of national single mineral reports, and more than 300 atlases.

(2) 3D Lithospheric Structure in China

Principal Investigators: Li Tingdong, Yuan Xuecheng, Xiao Qinghui, Huang Zongli, Ye Tianzhu, Geng Shufang, Fan Benxian, Gao Rui, Xiao Xuchang, Zhu Jieshou, Deng Jinfu, Yao Bochu, Zhang Xingzhou, Yang Wencai, and Lu Fengxiang.

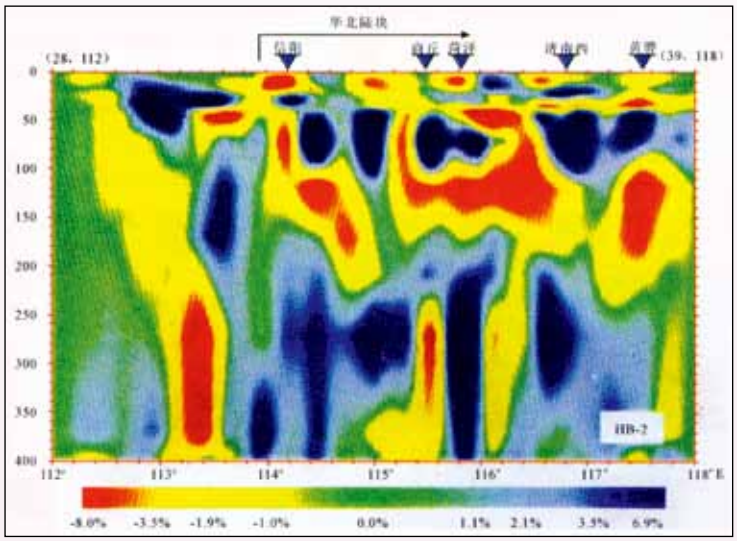
PI Organization: Institute of Geology, CAGS.

Twelve innovative achievements were obtained from the research of 3D lithospheric structure of the Chinese continent and offshore areas.

(1) There are large differences in lithosphere and asthenosphere between the eastern and the western China with 105°E as the dividing line (the north-south seismic belt). The western China is characterized by obvious layered deep structures, thick lithosphere and thin asthenosphere, whereas the eastern China has interlocking deep structures like mushroom clouds, the lithosphere is relatively thin, and the asthenosphere is as thick as 200-300 km. Such structures result in upwelling of asthenosphere and

extension and thinning of lithosphere in the eastern China.

(2) The lithosphere and asthenosphere in eastern China and marginal sea areas have fairly complex structure. The MOHO and the bottom interface of the lithosphere are uneven and discontinuous. Soft and hard blocks intercross each other and form a transition zone between crust and mantle for crust-mantle material interaction.



The tomography profile of the Xinyang-Huangye (transition zone)

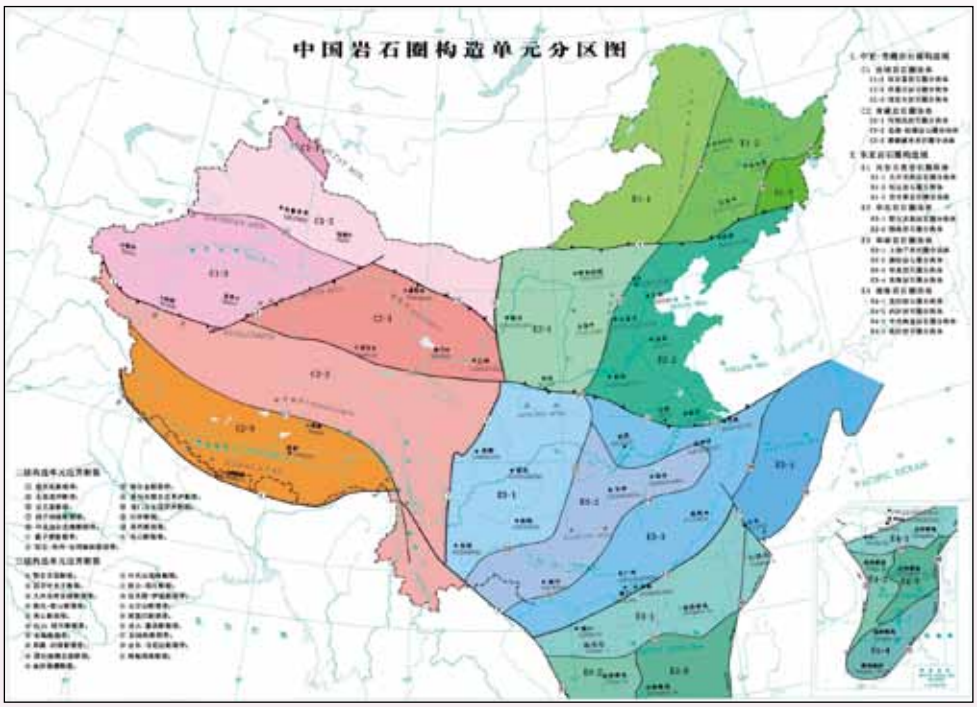
(3) Numerical modeling results of the dynamics of lithospheric thinning in the North China Block show that the areas affected by the subducted Pacific plate are limited to layers 200 km deep and bellow, especially within 200-300 km areas from the eastern coast of China. Therefore, the formation of the North China rift is related to the rise of hot mantle material rather than the Pacific plate subduction.

(4) New understanding about East Asia type orogeny was put forward in regard to strong Mesozoic tectonic-magmatic activities in eastern China. Such activities are interpreted to be caused by upwellings of deep asthenosphere material. The orogeny underwent three stages: the initial orogenic episode (230-180 Ma, the Early Mesozoic), the main orogenic episode (180-140 Ma, the Middle-Late Jurassic), and the late orogenic episode (140-65 Ma, the Cretaceous).

(5) The age structure of East China's lithosphere is characterized by the pattern of the lower layer being younger than the upper according to Nd isotope ages and peridotite xenoliths Os isotope test. The lithospheric of the Precambrian basement was displaced by the Mesozoic lithospheric material.

(6) A preliminary model of the Chinese continental lithosphere structure was established. 18 representative lithospheric histograms were made by means of integrated geological and geophysical research, and further 5 lithospheric types were proposed as follows: craton type, orogeny type, rift type, island arc type and marginal oceanic crust type.

(7) A classification scheme of tectonic units of China's lithosphere was proposed. The mainland and sea areas of China have been divided into 2 lithosphere tectonic domains with the N-S-striking Helanshan-Longmenshan structural zone as the boundary, i.e. the Middle Asia lithosphere tectonic domain and the Eastern Asia lithosphere tectonic domain, and 6 lithosphere blocks according to geologic, geophysical and geochemical features.

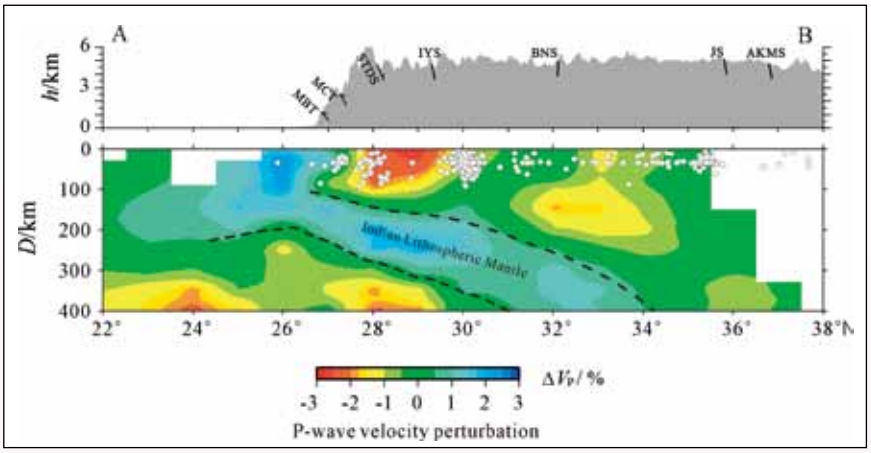


The distribution of the lithosphere tectonic units of China

(8) A giant meridional tectonic belt was identified by means of aeromagnetic survey in the Tibet Plateau. The north-south aeromagnetic anomaly is very obvious even as deep as 60-180 km, indicating inconsistency between the deep-seated structure and the surface structure.

(9) Tomographic images show that the Indian mantle has nearly horizontally thrust under the Tibet. The Indian lithospheric mantle is inserting northward from the Ganges plain to 33°N. Then, the Indian mantle broke off down to the asthenosphere. Its frontier has reached the deep part of the upper mantle beneath the center of the Qiangtang terrane at about 34°N latitude. The collision of the Indian plate and the Tarim plate is a direct collision under the Kunlun Mountains.

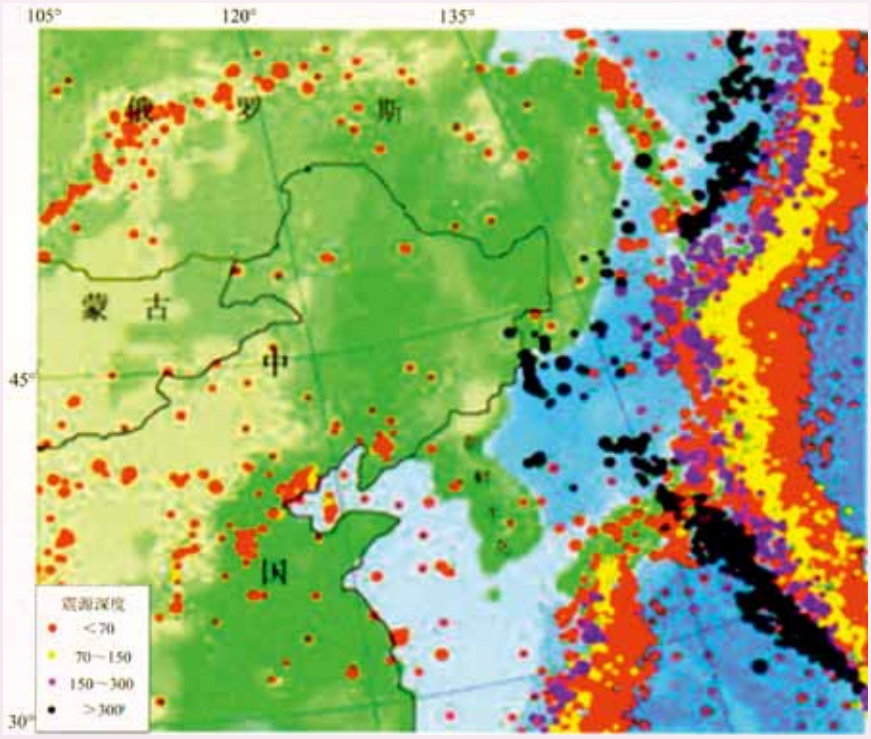
(10) The relationship between resources localization and deep process was studied in detail. Upwelling of asthenosphere material is the primary factor of strong Mesozoic magmatism and mineralization in eastern China. 80%-85% mineral products in the eastern China were formed in the Mesozoic. Large-scale mineralization took place when asthenosphere material upwelled with root loosing of the lithosphere.



The image of the Indian lithospheric mantle from south to north

(11) The mantle flow path was revealed. There are 3 channels in the Chinese continent for the mantle to move from west to east. The first one is Pamir-Tianshan-western Mongolia-Transbaikalia-Sea of Okhotsk. The second one is the northern Tibet Plateau-Liupanshan-Erdos-Yanshan-Liaodong peninsula-Sea of Japan and the third one is the southern Tibet Plateau-Sanjiang region-Honghe-South China Sea.

(12) The subducted Pacific plate caused deep-source earthquakes (540 km) in the Hunchun area, rather than shallow-focus earthquakes (< 30 km). There have never been violent earthquakes in the Korean Peninsula. East China is far away from the Pacific plate farther than the Korean Peninsula, so earthquakes in East China are not likely to be produced by the subducted Pacific plate.



The epicenter distribution of eastern China (the deep-focus earthquakes in Hunchun, Jinlin Province)

2 Second Prizes of the MLR Award for Science and Technology

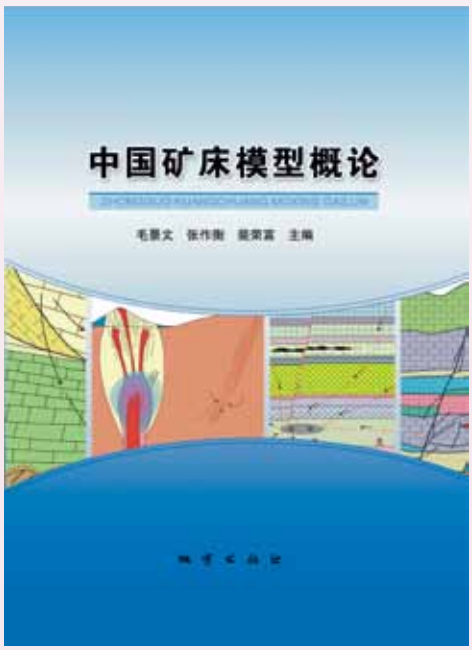
(1) Models of Main Metal Deposits of China

Principal Investigators: Mao Jingwen, Zhang Zuoheng, Pei Rongfu, Duan Huanchun, Fu Gonggu, Li Yongfeng, Wang Yitian, Xie Guiqing, Yu Jinjie, and Zhang Changqing.

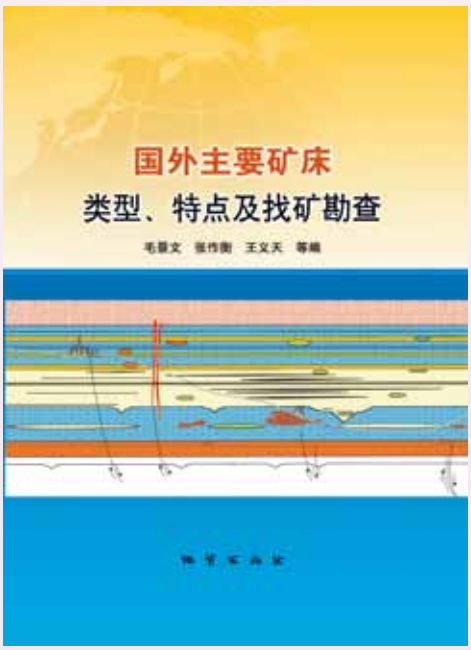
PI Organizations: Institute of Mineral Resources, CAGS; Tianjin North China Geological Exploration Bureau; Geology and Mineral Exploration Bureau of Hunan Province; and Xinda Geology and Mineral Resources New Technology Co., Ltd. of Henan Province.

In order to promote mineral resources exploration effectively, models for the major ore deposits were revised and improved on the basis of previous studies, which are applicable to neutral-acidic granitic rocks-related porphyry-skarn copper-iron-molybdenum deposits, mafic-ultramafic rocks-related copper-nickel sulfide deposits, acidic granite-related tungsten-tin deposits, marine volcanic-hosted massive sulfide deposits, sedimentary-hosted Mississippi Valley-type lead-zinc deposits and gold deposits. Universal mineralization models of the major mineral deposits in China, which could be used to guide mineral exploration, were also established. The achievements of this project can comprehensively promote and/or support the new round of mineral exploration in China, as well as carry out targeting in the deep and peripheral areas of old mines.

Two monographs and more than 70 papers were published during the implementation of this project. Five postdoctoral fellows, 8 Ph.Ds and 25 masters were funded by this project.



Introduction to Models of Deposits of China



Types, Characteristics and Prospecting of Major Deposits in Foreign Countries

(2) Explanatory Notes on the World Metallogenic Map of Large and Superlarge Deposits and Global Metallogenic Regularity

Principal Investigators: Pei Rongfu, Mei Yanxiong, Dai Zixi, Zhang Jinliang, Qu Hongying, Ye Jinhua, Zhu Guchang, Gong Yufei, Wu Dewen, and Wang Zuoyong.

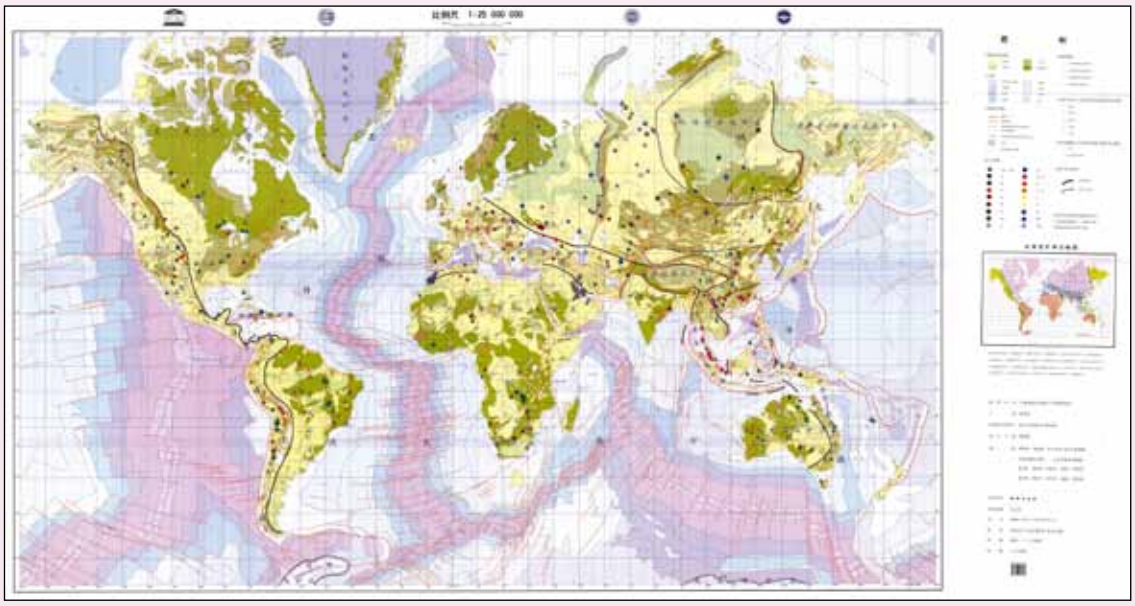
PI Organizations: Institute of Mineral Resources, CAGS; China Non-ferrous Metals Resource Geological Survey; and Development Research Center of China Geological Survey.

(1) Objective and practical standards for classification of global large and superlarge deposits were proposed. An internationally authoritative database of world large and superlarge deposits was built by selecting 445 large and superlarge deposits out of 1285 main deposits in the world.

(2) It completed the 1:25,000,000 digital world metallogenic map of large and superlarge deposits based on the World Geological Map Committee. This map is the first version of its type in the world.

(3) Four metallogenic domains and 21 huge metallogenic belts were first identified in the global continents. We put forward such concepts as the global metallogenic unity, the metallogenic particularity of different domains, and the mineralization preferentiality of large and superlarge deposits, and anomalous ore-forming process, hence having deepened the study as regards global metallogenic regularity.

(4) Based on the study of geological mapping, we appraised mineral resources of the main types in the world and all types of mineral resources in the continents, and discussed the stratagem questions regarding the mineral resources in China.



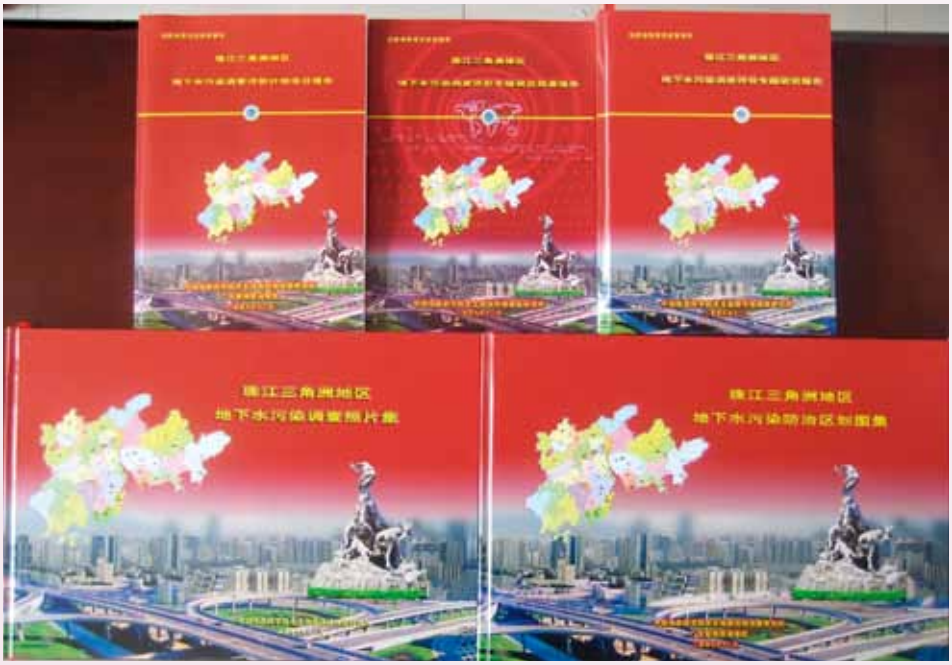
World Metallogenic Map of Large and Superlarge Mineral Deposits

(3) Groundwater Contamination Investigation and Assessment in the Pearl River Delta Region

Principal Investigators: Sun Jichao, Zhi Bingfa, Jing Jihong, Huang Guanxing, Liu Jingtao, Kong Dexiu, Qin Yisu, Wang Shan, Chen Xi, and Yao Pu.

PI Organizations: Institute of Hydrogeology and Environmental Geology, CAGS and Guangdong Geological Survey Institute.

By standardizing the process of surveying, sampling, and quality control, this project improved hydrogeological survey on the scale of 1:250000 and demonstrated the way for hydrogeological survey on the scale of 1:50000. Meanwhile, it put forward methods for groundwater quality and pollution level assessment. On the basis of investigating the groundwater quality and pollution in the Pearl River delta region, an atlas of groundwater pollution control and treatment was compiled, thus providing practical data for the groundwater pollution control and treatment plan and promoting national groundwater pollution investigation and assessment.



A Collection of Investigation and Assessment of Groundwater Pollution in the Pearl River Delta

(4) Rocky Desertification Research and Its Comprehensive Treatment in Guangxi Karst Mountain Area

Principal Investigators: Jiang Zhongcheng, Luo Weiqun, Deng Yan, Xun Xiaoqun, Xun Xingming, Li Xiankun, Zeng Fuping, Pang Donghui, Lu Shuhua, and Xiao Tu'an.

PI Organizations: Institute of Karst Geology, CAGS; Guangxi Institute of Botony, CAS; Institute of Subtropical Agriculture, CAS; Guangxi Technical Development Center for Mountain Areas.

To address problems of soil and water shortage and fragile ecosystems, we have studied the distribution, characteristics, formation and evolution of rocky desertification in southwestern China and their impact on resources, environment and economy. This project made five innovative achievements as follows: (1) Our research defined the rocky desertification concept as the process of land degeneration; (2) We systematically revealed the regional characteristics, historical forming process and dynamic mechanism of rocky desertification in Guangxi for the first time; (3) We found out the relationship between rocky desertification and soil-water loss, made quantitative evaluation of the difference of soil and water erosion in different parts of peak-cluster depressions and different environments; (4) We studied the characteristics of rocky desertification ecology and environment in consideration of the fact that karst dynamic systems can drive movement of elements; (5) We built an evaluation index system and model for karst peak-cluster depression areas.

Four monographs and more than 100 scientific papers were published, and 8 patents were received as results of this project. Our research made systematic achievements in regard to the study and treatment of karst rocky desertification.

(5) Publication of Rock and Mineral Analysis (the fourth edition)

Principal Investigators: Li Jiaxi, He Hongliao, Zhou Jinsheng, Ling Jinzhong, Cheng Shousen, Zhang Guanglong, Xu Shurong, Li Bing, Zhang Qin, and Ding Tiping.

PI Organizations: National Research Center for GeoAanalysis, Institute of Geophysical and Geochemical Exploration, CAGS; Institute of Mineral Resources, CAGS; Beijing Research Institute of Uranium Geology; Xinjiang Institute of Geology and Mineral Resources; Hebei Province Geological and Mineral Center Laboratory; and Institute of Hydrogeology and Environmental Geology, CAGS.

Rock and Mineral Analysis (fourth edition) is a monograph published in February 2011, and compiled by more than 200 specialists from 55 geological experiment and testing organizations in China. The publishing project was organized by the Branch of Geology and Mineral Resources of Chinese Society for Measurement and the National Research Center for GeoAnalysis. The monograph is composed of four volumes with 90 chapters, which introduces extensive knowledge in geoanalysis, including the basic concept and common technologies, basic principles of

instruments in geoanalysis, analytical technologies and methods in such fields as rocks and ores, energy minerals, marine geological survey samples, geochemical survey samples, water samples, isotopes and micro-analysis.

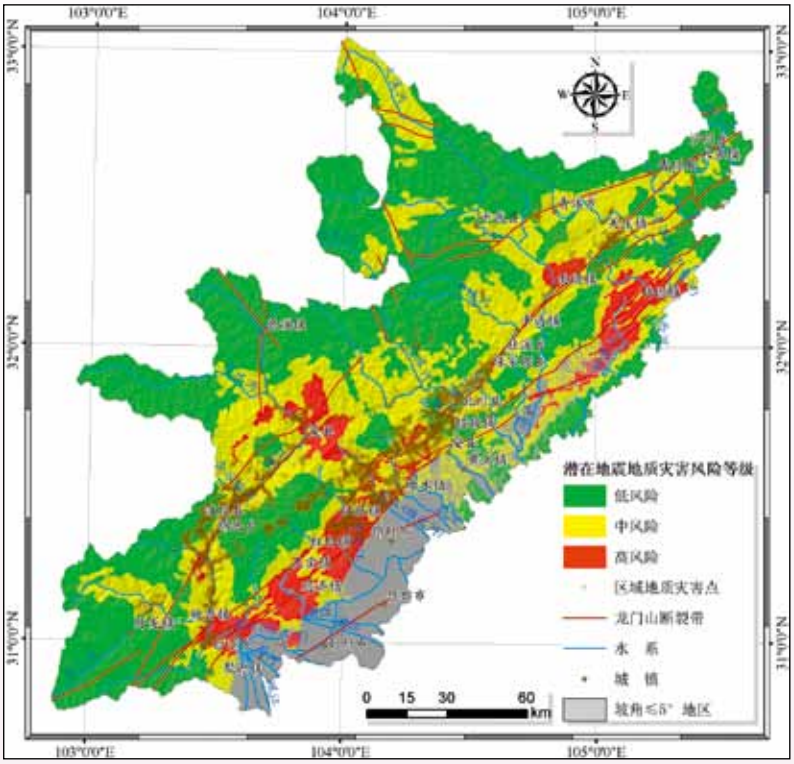
The extent and extensive numbers of new results in the monograph demonstrates significant new demands of the geological work for experiment and testing, and the progress in geoanalysis. The monograph serves as a synthesized, systematic and authoritative reference book in geoanalysis. It will provide technological support in earth science, geological survey and mineral exploration, and promote overall advance in geoanalysis. This reference book is suitable to related industries, such as nonferrous metals, metallurgy, petroleum, environment protection, gold, business inspection and nuclear industry.

(6) Landslide Risk Assessment Theory and Technology

Principal Investigators: Wu Shuren, Shi Jusong, Wang Tao, Zhang Chunshan, Han Jinliang, Tan Chengxuan, Li Bin, Sun Weifeng, Sun Ping, and Xin Peng.

PI Organization: Institute of Geomechanics, CAGS.

The project systematically summarizes and provides landslide risk prediction and assessment theory, technologies and methods, and workflows. The research project achieves several breakthroughs in significant theoretical and technical issues. The innovative achievements have 5 aspects: (1) Landslide risk prediction and assessment theory was developed based on the "cause theory, statistics theory and information theory", and 6 kinds of qualitative and 5 kinds of semi-quantitative to quantitative assessing methods of easy application were provided; (2) The first technological guideline of landslide risk assessment was completed. In this guideline, landslide risk assessment and the management framework and technical process are established. The method of landslide inventory → database establishment → susceptibility →hazard →risk assessment and charting technology was clarified; (3) An preliminary analytic method for extreme landslide cases was proposed, which can be applied to predicting the future probability of possible catastrophic landslide; (4) Preliminary landslide intensity evaluation methods and grading levels were put forward, in which landslide areal density or point density could serve as the grading basis of the region scale landslide intensity index; (5) Taking the Wenchuan Ms8.0 earthquake as an example, rapid assessment technology of seismic landslide hazards and losses based on the simplified Newmark displacement model, and landslide risk assessment induced by rainfall after mainshock and potential earthquake were proposed. These achievements have made important contributions to promoting the standardization of landslide risk assessment and development of disaster mitigation work in the Chinese mainland.



A map of landslide risk assessment induced by potential rainfalls and earthquakes after the mainshock in the Wenchuan earthquake-hit area

(7) Study on the Patterns and Forming Mechanism of Fracture-cavity Systems in Ordovician Carbonate

Principal Investigators: Xia Riyuan, Zou Shengzhang, Liang Bin, Tang Jiansheng, Chen Hongfeng, Zhong Jianhua, Gu Hanming, Cao Jianwen, Zhang Qingyu, and Lu Donghua.

PI Organization: Institute of Karst Geology, CAGS.

The Tarim basin, a large sedimentary basin, presently is the most promising basin for ore prospecting in China. Middle-Lower Ordovician carbonate rocks constitute the primary formations of paleokarst and fractured-cavernous reservoirs. Research methods on oil-gas field paleokarst were put forward according to the traits of multivariate controlling paleokarst. In other words, on the basis of integrated analysis on paleogeology, paleotectonics, paleotopography, paleoclimate and paleohydrogeological settings, comprehensive study on paleokarst, including macroscopic and microscopic, exposed and buried, erosive and filled features should be conducted by means of the application of analysis on genesis and combination of karst features, hydrodynamics, geochemistry, and geophysics, and then spacing difference, vertical zonation and multi-stages of paleokarst fracture-cavity were studied to build the genetic model and structure model. According to the characteristics of paleokarst and the relation of paleokarst with reservoir properties, 10 typical models of fracture-cavity systems were proposed. The results will provide a guide to effectively predict enrichment zones and exploration of oil and gas.

Thickness contour map of the epikarst zone in block 4 in the Tahe oil Field

(8) Paleogene-Neogene Environmental Evolution of the key Paleolakes, Tibet

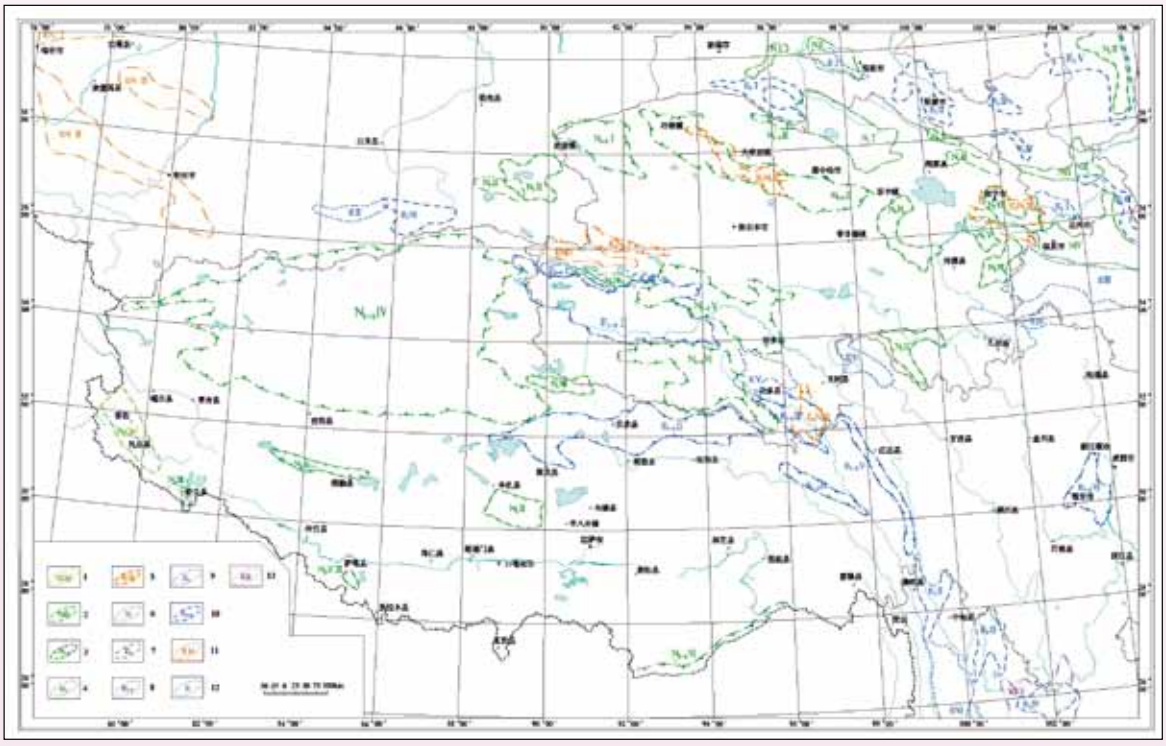
Principal Investigators: Meng Xiangang, Shao Zhaogang, Han Jian'en, Wang Jin, Yu Jia, Zhu Dagang, Sun Liqian, Yang Chaobin, Meng Qingwei, Lü Rongping.

PI Organization: Institute of Geomechanics, CAGS.

The distribution map of Paleogene-Neogene fluvial-lacustrine strata in the Qinghai-Tibetan plateau (1:2500000) was made for the first time. According to the geological age of the lacustrine strata, the Paleogene-Neogene paleolakes can be divided into 5 lake-forming periods and 13 lake-forming stages, and 63 Paleogene-Neogene paleolakes were delineated for the first time. It is the first time to find Rhinocerotidae fossil in the Pliocene strata. Therefore, discoveries of fossils such as Rhinocerotidae in Pliocene fluvial-lacustrine sediments in the Ngari Zanda Basin are of important significance for further investigation of the processes of uplift of the Qinghai-Tibet Plateau, environmental changes, origin of Rhinocerotidae, etc. Meanwhile, the discoveries also provide actual data for the response to the Himalayan movement in the Qinghai-Tibet Plateau and for further analysis and discussion on the law of the tectonic movement in the Qinghai-Tibet Plateau since the Neogene. Two widely distributed unconformities (between the Tuolin Formation and the Guge Formation, the Guge Formation and the Xiangzi Formation) were confirmed in the region for the first time, which determined the existence and universality of these two contact relations. In addition, these two tectonic movements are named the

"Xiangquan movement" and "Guge movement" respectively, providing new basic data for the rapid uplifting and regional tectonic evolution of the Qinghai-Tibet Plateau since the Neogene. This set of fluvial-lacustrine strata were redefined into three formations (Xiangzi Formation), Guge Formation Tuolin Formation, 7 sedimentary facies and 11 lithologic members. The bottom of the Quaternary strata in the Zanda Basin was confirmed for the first time. A large amount of glacial profiles of the middle-late Early Pleistocene in the Zanda Basin were portrayed for the first time, providing actual evidence for the division and correlation of glacial phases, and also providing new and important evidence for the evolution of the global glacial climate.

The genesis of the Zanda Basin was determined, as a "seesaw type" semi-garben basin for the first time. Based on the analysis of sedimentology, sequence stratigraphy, palaeontology, geomorphology, geochemistry, geochronology, micropaleontology paleontology, paleoenvironment and paleoclimate, it is considered that the Zanda Basin has undergone a process of sub-tropical humid climate → temperate humid climate→ cool humid climate → cool dry climate along with rapid uplifting of the Qinghai-Tibet Plateau from 5.3 Ma to 1.36 Ma B.P.



Distribution map of Paleogene-Neogene paleolakes in the Qinghai-Tibetan plateau

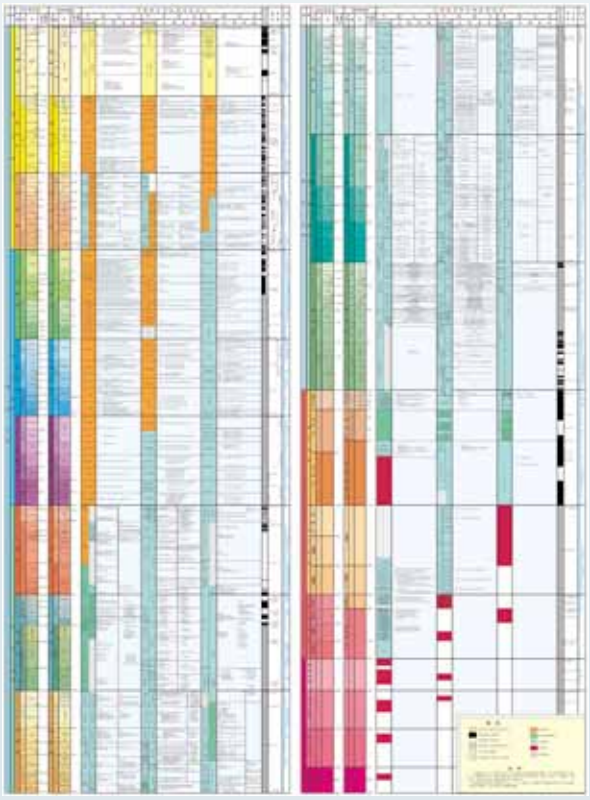
1. Pliocene-Early Pleistocene lakes; 2. Pliocene lakes and numbers; 3. Miocene-Pliocene lakes; 4. Miocene-Pliocene lakes; 5. Oligocene-Miocene lakes; 6. Neogene lakes; 7. Oligocene lakes; 8. Eocene-Oligocene lakes; 9. Eocene lakes; 10. Paleocene-Eocene lakes; 11. Paleogene-Neogene lakes; 12. Paleogene lakes; 13. Cretaceous-Paleogene lakes

Chapter V Top 10 Scientific and Technological Advances of CAGS in 2013

The top ten scientific and technological advances of the Academy in 2013 were selected and announced in January 2014, as a result of a vigorous review process. The selection was initially narrowed to 21 outstanding achievements selected from 1022 research projects and then those 21 were presented and reviewed by the appraisal committee composed of 42 academicians and experts, and finally the top 10 major scientific and technological advances were selected.

1 Stratigraphic Chart of China and Description

With the aid of the CGS, the team led by Wang Zejiu and Yao Jianxin of the National Commission on Stratigraphy of China synthesized stratigraphic and paleontological data and new achievements from different periods and regions, drew up a colorful hanging "Stratigraphic Chart of China". This stratigraphic chart covers the international geologic time scale, chronostratigraphy of China, lithostratigraphy and biostratigraphy subdivision of China, magnetostratigraphy, event stratigraphy and sea level change, makes stratigraphic subdivision and correlation of different regions, and presents corresponding description of the stratigraphic chart. The Stratigraphic Chart of China bears important scientific significance and strong practicality. It was exhibited and discussed in the 34th International Geological Congress and the 4th National Stratigraphy Congress, and earned favorable comments and great attention of international and Chinese geologists.



Stratigraphic Chart of China (new edition)

2 The independently developed UAV Magnetic/Radioactive Survey System

A novel prototype UAV aeromagnetic and radiometric integrated survey system was developed by Li Wenjie and his research team from the Institute of Geophysical and Geochemical Exploration. The research was supported by the Geological Survey Project from the CGS, and included aircraft modification, electromagnetic compatibility, high quality magnetic measurement and remote control technique. The UAV airborne integrated geophysical system was independently developed based on the domestic Rainbow-3 UAV. The bottleneck of using UAV to carry out survey in low-altitude areas was overcome and new technique for the extremely low altitude survey following the terrain was developed. A 3000 km trial survey, which is the first UAV geophysical trial survey in China, was carried out to test the performance of the prototype system, such as stability and reliability. The core features of the UAV system are world class. Some more optimization researches need to be conducted in order to make the system commercially feasible for geological and mineral surveys.

A prototype UAV airborne magnetic/radioactive integrated survey system

3 Discovery of the Duolong Epithermal Copper-Gold Deposit in Tibet

The team of Prof. Tang Juxing from the Institute of Mineral Resources, together with Aluminum Corporation of China and the No. 5 Geological Team of Tibet , under the auspices of the Commercial Exploration project, the Evaluation Project of the Qinghai-Tibet Geological Survey and the 973 Project, discovered a super-large epithermal copper-gold deposit in the Duolong ore district and investigated the geological characteristics of the South Tiegelong copper-gold deposit. It was documented that mineral assemblages of alunite, covellite, enargite, digenite, etc. were formed in the epithermal deposit. According to comprehensive information, the South Tiegelong deposit was defined as the first HS epithermal deposit in Tibet. A detailed survey showed that copper and gold resources of more than 500 million tons and over 50 tons have been defined respectively. The maximum thickness of the ore body (indicated) is greater than 900 m. The average copper grade of the deposit is 0.55% and the industrial copper grade is 0.64%. This super-large deposit becomes the second case of super-large “Zijin type” copper-gold deposits in the mainland of China, which is of great potential economic significance and serves as an important guidance for both regional exploration for ore deposits and development of mineral resources.

Exploration site of the South Tiegelong Cu-Au deposit in the Duolong ore-concentrated area, Tibet

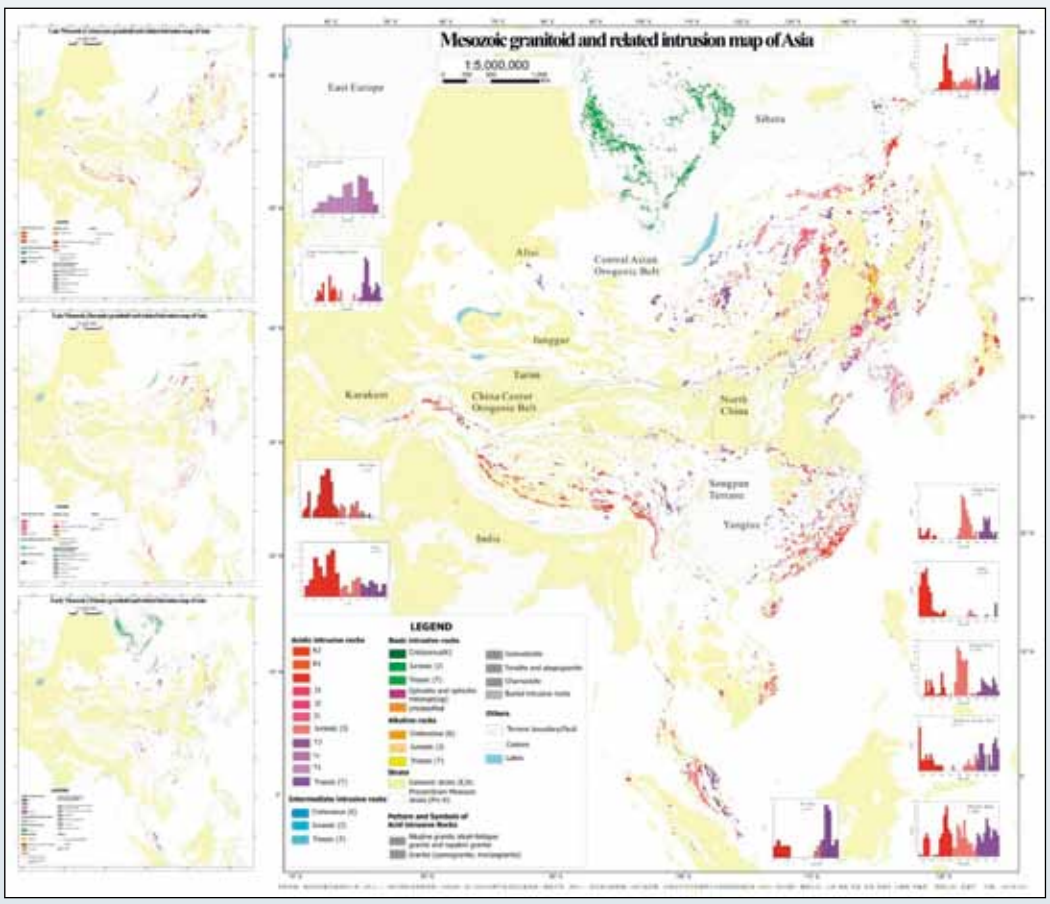
4 Evolution and Controlling Mechanisms of Groundwater in the North China Plain

Under the auspices of the 973 project, nearly one hundred researchers headed by Prof. Shi Jiansheng from the Institute of Hydrogeology and Environmental Geology restored the evolution characteristics of the hydrodynamic field in the North China Plain during the past 60 years, identified the response of hydrodynamic field to human activities and natural variations, deepened understandings of aquifer heterogeneity, changes of vadose zone hydraulic parameters, dynamics of soil water potential and temperature in deep vadose zone, water releasing and deposition mechanism of deep confined aquifers. Besides, through membrane effect test, leakage mechanism was analyzed, evaluation of groundwater resources carrying capacity was studied, critical identifying indicators of groundwater crisis were built, and control measures for easing the crisis of groundwater in the North China Plain were raised, which significantly improved the research level of large basin groundwater systems in China and offered significant scientific and technological support for reducing water resources shortage in the North China Plain.

Field meeting with staff on agricultural water saving and groundwater control measures in the Hebei Academy of Agricultural and Forestry Sciences

5 Major Advances in the Compilation and Research of the Mesozoic Granitoids and Related Intrusions Map of Asia

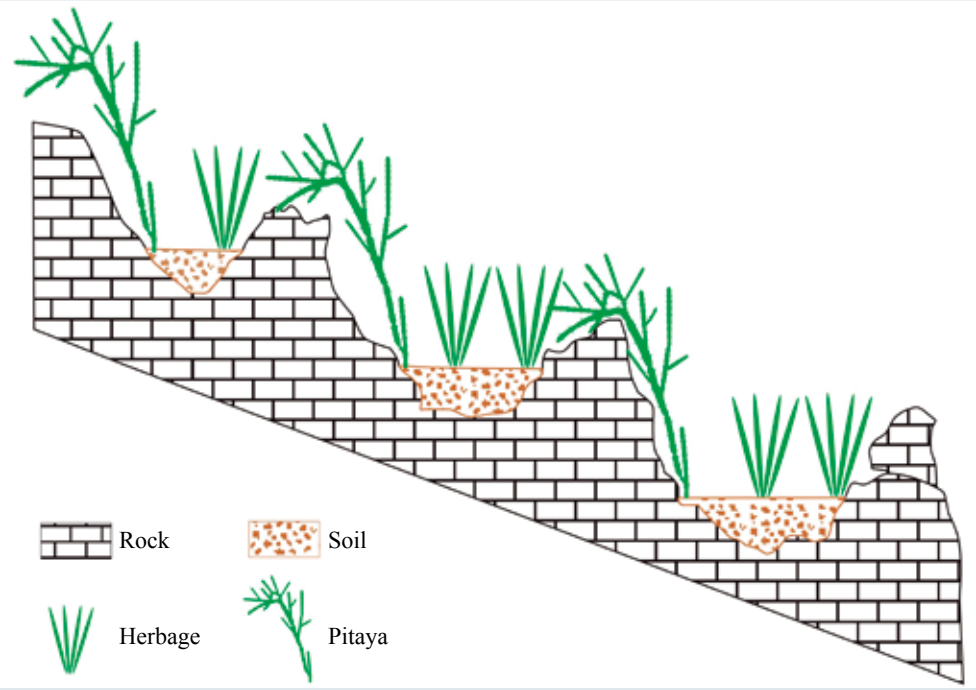
Funded by the CGS, MOST and NSFC projects, Prof. Wang Tao and his team from the Institute of Geology, CAGS undertook comprehensive research on Mesozoic granitoids in China and adjacent areas. First, they identified many Mesozoic plutons in Central Asia and the China Central Orogenic Belt and systematically summarized their spatial and temporal distribution, and evolution and source characteristics. Based on previous studies, they redefined the distribution of the late Mesozoic granitoids in northeastern Asia. Second, they discussed the relationship between magma evolution and tectonic settings for the Mesozoic granitoids of Asia and proposed preliminary tectonic settings and a framework of continental convergence and divergence of these rocks. Third, a digital profile-driven map of Mesozoic granitoids of Asia was compiled. These contributions of Chinese researchers to the study of Mesozoic granitoids of Asia are of great significance for exploring tectonic evolution and metallogenic settings of Asia in the Mesozoic. Some results were published in highly influential international journals in 2013, including Earth Science Reviews, American Journal of Science and Lithos.



Mesozoic granitoids and related intrusions map of Asia

6 Research and Prevention of Soil Leakage in Karst Peak Cluster Depressions

Sponsored by the scientific projects from the MST, Ministry of Water Resources and the Guangxi Zhuang Autonomous Region, Prof. Jiang Zhongcheng and his research team from the Institute of Karst Geology, CAGS achieved important results in the study of processes, dynamic mechanisms and prevention technology of soil and water leakage in karst peak cluster depressions. By using on-site monitoring and advanced isotopic technique, the team firstly and systemically revealed quantitative differences and causes of water leakage and soil erosion in different geomorphologic positions and ecological environments of karst peak cluster depressions, proposed grade classification standards and a regression model of soil erosion in karst areas, created new water and soil conservation models which integrate biological methods with engineering and technological rules, and formed the pitaya ecological production industry with good ecological and economic benefits in a karst rocky desertification environment. All these research results can provide technological support and demonstration examples for the treatment of rocky desertification and conservation of water and soil in karst areas in Southwest China.



Terraced planting of pitaya and pasture on karst slopes

7 Theory and Technique of Evaluation and Prognosis of Key Mineral Resources in China

Prof. Xiao Keyan and his team from the Institute of Mineral Resources, CAGS proposed ore deposit modeling and synthetic information methods for mineralization evaluation under the guidance of experts such as Academician Chen Yuchuan and Prof. Ye Tianzhu, and by referring to the experience from both China and abroad. The whole process for mineral resource prognosis method was based on the GIS platform. The evaluation was conducted for 22 key mineral resources, including iron, bauxite, copper, lead, zinc, tungsten, tin, molybdenum, REE, gold, silver, antimony, manganese, chromite, nickel, lithium, magnetite, leopoidite and boron etc. A database of mineral resource evaluation was built. About 50,000 targets and prospective areas of different kinds and different grades were delineated, from which provincial prospective areas and countrywide prospective areas were selected and inferred resources were evaluated, which has provided important information to the deployment of mineral exploration work in China.

The mineral resource assessment system (MRAS)

8 The Earliest-known Multituberculate Mammal in Jurassic from Liaoning Province, China

Funded by the MST (Project 973), the MLR, the Science and Technology Commission of the Beijing Municipal Government, and by the National Science Foundation of the United States and the University of Chicago, Prof. Ji Qiang and his team discovered a new fossil mammal from 160 million years old strata in Jianchang County of Liaoning Province, China.

The new mammal has been named Rugosodon eurasiaticus after the rugose teeth ornamented by numerous tiny ridges and grooves and pits, indicating that it was an omnivore that fed on leaves and seeds of ferns and gymnosperm plants, plus worms and insects. Its ankle bones are surprisingly mobile and flexible, suggesting that Rugosodon was a fast-running and agile mammal. It is also very important that Rugosodon is the earliest-known skeletal fossil of the multituberculates, and through its study paleontologists can trace the evolutionary origins of the versatile and diverse locomotor adaptations of later multituberculates that include tree climbers, ground runners, and digging mammals living underground. This fossil helps to shed light on the earliest evolution of multituberculates, a major group of extinct mammals that lived in the Mesozoic of dinosaurs and ultimately survived the mass extinction that wiped out dinosaurs 65 million years ago.

Ecological reconstruction of Rugosodon eurasiaticus

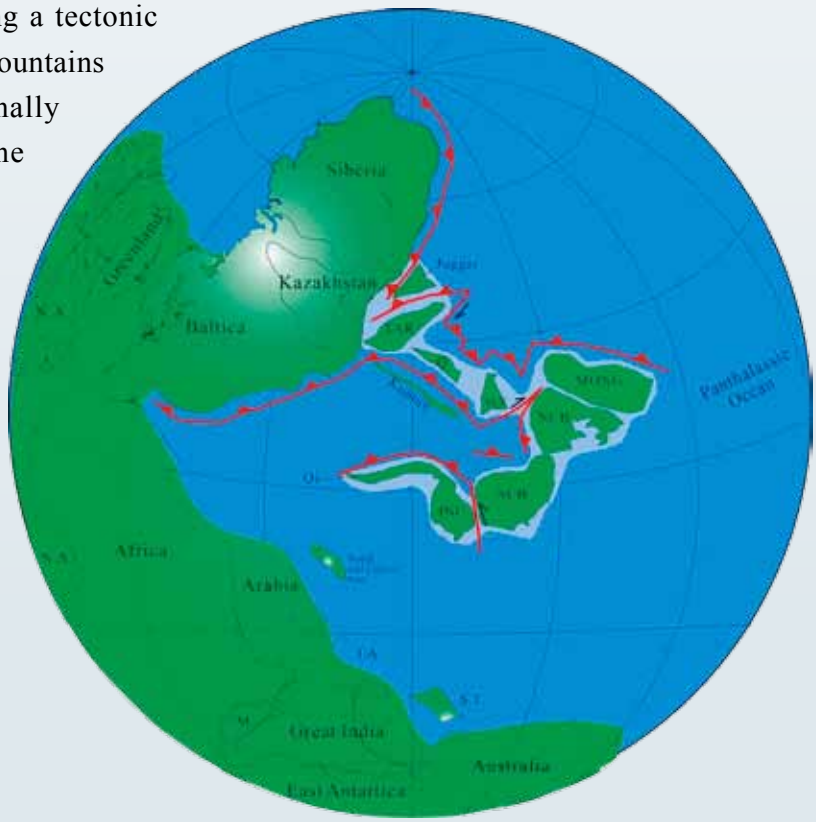
9 The Re-Os Isotope Analytic Technology Offers a New Approach to Sedimentary Rock Dating

With the help of the MOST, NNSF and CGS, the research team on Re-Os isotope of NRCGA, led by Drof. Qu Wenjun, pioneered the research on the analysis method of sulfide Re-Os dating in China, expanded its applications, and made remarkable achievements. In the wake of the molybdenite dating method, the team successfully developed a range of national first reference materials (such as Cu-Ni sulfide and Co-rich crust). They also improved the sample preparation approaches and high temperature and pressure digestion technologies, established the Re-Os analysis procedure and dating methods suitable to pyrite, arsenopyrite, limestone, graphite, bitumen and other low Re-Os content samples. The main technical indicators of this lab, such as the procedure blank, accuracy and precision, have reached international advanced standards. Their work has provided a way for dating sedimentary rock, hydrocarbon source rock and oil-gas reservoirs.

Re-Os isotopic dating analysis

10 Important Progress in the Pre-Mesozoic Tectonic Evolution of the Alxa Block, Xinjiang

A combined detrital zircon U-Pb geochronology and Hf isotopes and paleomagnetic study on the Late Devonian-Middle Triassic strata was carried out by the research group headed by Drof. Yang Zhenyu of the Key Laboratory of Paleomagnetism and Tectonic Reconstruction, MLR at the Institute of Geomechanics. The finding results indicate that the detrital zircons cover five age populations: 0.4–0.7 Ga (peak at 488 Ma); 1.0–1.3 Ga (peaks at 1001 and 1152 Ma); 1.5–1.8 Ga; 2.4–2.8 Ga (prominent peak at 2506 Ma and secondary peaks at 2668 and 2796 Ma); and >3.0 Ga (peak at 3332 Ma). Zircons with U-Pb age spectra of 2.4–2.7 and >3.0 Ga and their corresponding εHf(t) values are significantly different from those in the North China Block (NCB), indicating that these detrital zircons are not from the NCB, which implies that the Alxa terrane was not a part of north China until the Middle to Late Devonian. Paleomagnetic results yielded from the Early Carboniferous limestones and the Late Permian purple sandstones sampled in the eastern Alxa terrane (ALT), northwest China indicate that the apparent polar wander path (including early Carboniferous, Late Carboniferous-Early Permian, Late Permian and Early-Middle Triassic poles) is significantly different from those of the NCB. If the APWP of Hexi Corridor-Alxa rotated counterclockwise by 32° around the Euler pole at 44°N, 84°E, then the coeval APW path of the ALT overlaps that of the NCB. This result indicates that the ALT migrated to the NCB after the Early-Middle Triassic along a tectonic boundary between the Helanshan Mountains and Zhuozishan Mountains, and finally amalgamated to the NCB before the Early Cretaceous. The result provides original data which will deeply promote our understanding of the Mesozoic tectonic evolution of northern China.



Reconstruction of the Late Triassic Paleogeography

Chapter VI 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 of research disciplines and also important grounds to attract, train and support exceptionally talented and innovative professionals in science and technology.

By the end of 2013, 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 15 field observatories set up by the MLR, 11 professional centers of the CGS, 5 popular science bases and 4 ministerial testing centers of the MLR.

International platforms

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

National platforms

Ser. No.	Name	Supporting Institution	Director
1	State Key Laboratory of Continental Tectonics and Dynamics	Institute of Geology, CAGS	Xu Zhiqin
2	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 Shuan
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 of 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 Desertification	Institute of Karst Geology, CAGS	Jiang Zhongcheng
14	MLR Key Laboratory of Karst Dynamics		Yuan Daoxian

CGS Key Laboratories

Ser. No.	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

Continued

Ser. No.	Name	Supporting Institution	Director
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	Institute of Karst Geology, CAGS	Lei Mingtang

CAGS Key Laboratories

Ser. No.	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, CAGS	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	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.	Name	Supporting Institution
1	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

Ser. No.	Name	Supporting Institution
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	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 Institution
1	Karst Geology Museum of China	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 for 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

Continued

Ser. No.	Name	Monitoring and Test Scope	Undertaken by
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; metals and nonmetals; physical properties of rock and soil test	Institute of Karst Geology, CAGS

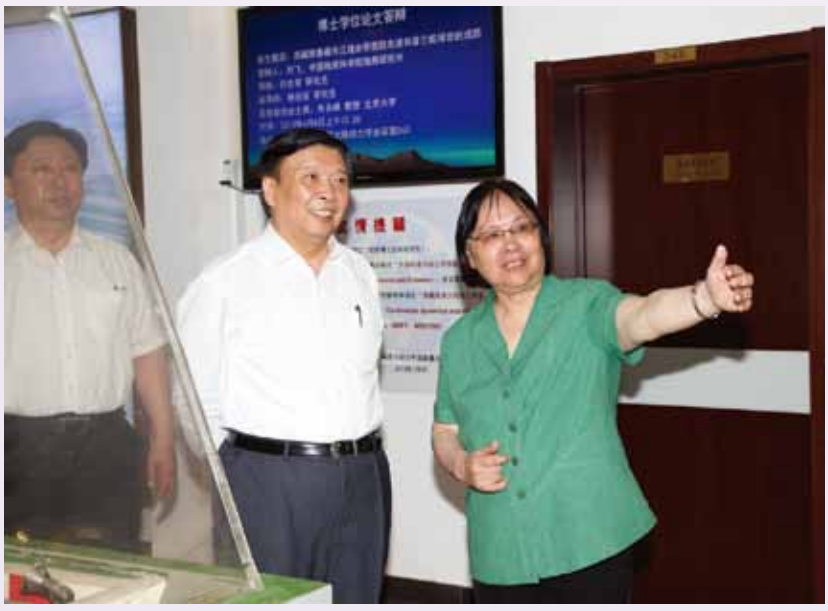
1 National Scientific Research Platforms

(1) State Key Laboratory of Continental Tectonics and Dynamics

Supported by the Institute of Geology, CAGS, the laboratory was established in 2011.

From the viewpoint of global tectonics, the lab focuses on comprehensive study of the composition, structure, behavior, dynamic evolution and deep driving mechanism of the continent in terms of field investigation, deep geophysical probing, continental drilling, isotope geochemical tracing and long-term borehole observations. The tasks of the laboratory include exploring and resolving crucial problems regarding the continental structure and dynamics of China (Asia), establishing a theoretical system of continental structure and dynamics, promoting the development of solid earth science, enhancing the level of non-profit geological investigation of China, and serving national interests concerning resources, energy and mitigation of disasters and social demands.

In 2013, 143 scientific papers were published, including 85 SCI-indexed papers and 55 in international SCI-index journals.



Minister Jiang Daming visiting the State Key Laboratory for Continental Tectonics and Dynamics on June 4, 2013

(2) Beijing SHRIMP Center

Supported by the Institute of Geology, CAGS, the center, as one of the earliest basic science and technology infrastructure platforms approved by the MST and Ministry of Finance, is dedicated to the study of geochronology and cosmic chronology, new dating techniques and methods, rare-earth geochemistry in mineral microzones, the study of chronogenesis of major events in geological history, especially the formation and early history of the solar system and the earth, tectonic evolution of major orogenic belts, geological time scale and metallogenic epochs of large and special ore deposits, as well as research and development of relevant scientific instruments.

In 2013, 153 research papers were published to report results analyzed from a single SHRIMP instrument, including 72 English papers indexed by SCI. These productive records rank the center's SHRIMP instrument the most productive instrument of the same kind in the world.

The Beijing SHRIMP Center was moved to its new building, located in the Zhong Guan Cun Life Science Park on Bei-qing Road. The two SHRIMPs of the Center passed the installation acceptance test successfully in the new lab building and re-opened its analytical service to the public.

The main chamber of TOF-SIMS-REE

(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. Owing to its good tracking records, this research center again received the national support in 2013.

(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 scientific and technical resources. The researchers are to strive 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 Ministry of Land and Resources

(1) MLR Key Laboratory of Isotope Geology

Supported by the Institute of Geology, CAGS, the lab adheres to the following research directions: deep continental scientific drilling (dynamics of plate convergence boundaries and modern crustal processes), huge ultrahigh-pressure metamorphic belts and N-S-convergence of continental plates, terrain amalgamation and collision dynamics of the Qinghai-Tibet Plateau.

In 2013, 25 scientific papers were published with this laboratory or its correspondent as the first author and 6 of them were indexed by SCI.

(2) MLR Key Laboratory of Stratigraphy and Paleontology

This laboratory is supported by the Institute of Geology, CAGS and addresses the following major research tasks: developing important basic theories on stratigraphy and paleontology, solving crucial stratigraphic and paleontologic problems in land and resources investigation, developing new technical and method systems, conducting research covering early life evolution, biologic and geological

environment changes, and dating and correlation of major strata.

In 2013, 26 academic papers were published with this laboratory or its correspondent as the first author, including 1 paper in Science and 14 papers in scientific periodicals indexed by SCI. One monograph was published.

(3) MLR Key Laboratory of Earthprobe and Geodynamics

The laboratory is supported by the Institute of Geology, CAGS and focuses its research work on deep metallogenic processes with the aid of deep probing of the continental lithospheric structure and geodynamic research.

In 2013, 31 papers were published in academic journals indexed by SCI with this lab or its correspondent as the first author, including 22 papers published in international periodicals and 10 in national journals.

Minister Jiang Daming inspected a lab in the CAGS on June 4, 2013

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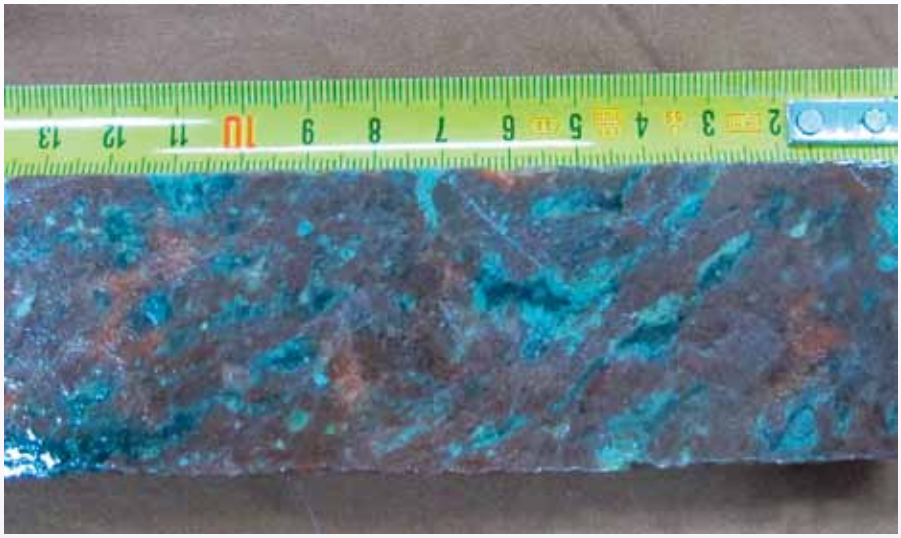
(4) MLR Key Laboratory of Metallogeny and Mineral Resource Assessment

This laboratory is supported by the Institute of Mineral Resources, CAGS. The lab is dedicated to the following research fields: ore-forming processes and backgrounds, 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.

107 scientific papers were published in 2013, of which 37 were SCI-indexed papers, 21 published in international journals indexed by SCI, and 70 papers in national journals. The lab published 2 monographs and received 2 invention patents of China and 3 national patents for utility models.



Drilling core of potassium-bearing halite from borehole MK-1

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

The laboratory is supported by the Institute of Mineral Resources, CAGS. The main research directions 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.

A prospective area for potash deposits was discovered in Ninghai, Pu'er City in Yunnan Province with the main salt-bearing series occurring at a depth of 500-1500 m. A pilot environment correlation field was established in the salt lake area in the Qaidam Basin.

In 2013, 23 research papers were published with 4 papers in international journals and 4 in Chinese journals, all indexed by SCI, 3 papers in Chinese journals indexed by EI, and 12 papers in Chinese core journals.

(6) MLR Key Laboratory of Neotectonic Movement and Geohazard

Supported by the Institute of Geomechanics, CAGS, this laboratory focuses on the following research directions: neotectonics, seismic geology, engineering geological effect of mobile faults, formation and evolution of catastrophic geological hazards brought about by coupling of endodynamic and exodynamic processes, theories and methods for the prediction and evaluation of severe geological hazards and establishment of the technical exchange platform and research base of active structure and mitigation and prevention of geological hazards, so as to propose policy-making information and technical support to the national strategy for mitigating and alleviating natural disasters.

In 2013, 71 research papers were published, including 19 papers indexed by SCI, 7 indexed by EI, 28 in

China's core journals, 10 in science and technology core journals. Three monographs were published. The lab received two invention patents of China and one national patent for utility models.

(7) MLR Key Laboratory of Paleomagnetism and Paleostructure Reconstruction

The laboratory is supported by the Institute of Geomechanics, CAGS. Carrying on and innovating Prof. Li Siguang's geomechanic theory and taking paleomagnetic research as the technical core, the lab focuses its research on restoration of paleotectonics; cutting-edge scientific problems such as global climate change, metallogenic background of large ore deposits, evolution of paleoenvironment and paleoclimate and process of large-scale active fault belts; making extensive application of paleomagnetic methods to new fields including mineral exploration and mechanisms of faulting process.

In 2013, over 30 research papers were published, including 13 SCI-indexed and 2 EI-indexed papers, and 11 papers were published in China's core journals.

(8) MLR Key Laboratory of Eco-geochemistry

This key laboratory is supported by the National Research Center for GeoAnalysis, adhering 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 recuiting 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.

In 2013, 30 research papers were published, including 17 papers indexed by SCI.

(9) MLR Key Laboratory of Groundwater Science and Engineering

The laboratory is supported by the Institute of Hydrology and Environmental Geology, CAGS and is to meet 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.

The laboratory started two research projects in 2013, both supported by the IAEA, "Recharge and hydrodynamic response to intensive groundwater abstraction in the North China Plain, assessed by repetitive analysis of isotopic tracers" and "Age-dating of very old groundwaters in confined aquifers of the coastal plain in the North China Plain".

(10) MLR Key Laboratory of Geochemical Survey Technology

This laboratory is supported by the Institute of Geophysical and Geochemical Exploration, CAGS and is dedicated to the following research tasks: carrying out innovative, basic and public research on

geochemical exploration, geochemical mapping technique, geochemical survey technology, and deep-penetrating geochemical survey theory and technology.

In 2013, a geochemical map of rare earth and rare dispersed elements of China and the geochemical baseline map of radioactive elements (Th, U, K) of China were accomplished. The basin-penetrating geochemical survey theory and technology was developed, and has been effectively applied to regional survey of sandstone-type uranium deposits in the Ordos Basin.

On-site operation of a geophysical exploration technique

(11) MLR Key Laboratory of Geophysical Electromagnetic Exploration Technology

The supporting institute of this laboratory is Institute of Geophysical and Geochemical Exploration, CAGS. It focuses on airborne electromagnetic survey, ground electromagnetic survey, downhole electromagnetic survey and electromagnetic survey, information processing and other basic researches, and provides technical support for undertaking basic and strategic research of the national geological survey.

In 2013, the significant accomplishment of the lab is that the effectiveness of geophysical-geochemical exploration for natural gas hydrate (NGH) in permafrost regions was verified through drilling.

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

The laboratory is supported by the Institute of Karts Geology, CAGS and adheres to the following research directions: revealing the structure, function and change patterns of karst ecosystem; scientifically analyzing ecological problems related to rocky desertification, soil erosion and vegetation degradation in karts regions; systematic monitoring and recovery of typical fragile karst ecosystems and exploring key techniques and ways for comprehensive control on rocky desertification, water and land conservation, recovery of karst ecological and hydrological systems.

In 2013, 31 academic papers and 1 monograph were published, of which 5 papers were published in SCI indexed journals. 11 academic conferences or seminars were organized.

(13) MLR Key Laboratory of Karst Dynamics

The laboratory is supported by the Institute of Kart Geology, CAGS. By carrying on our locality advantage and international influence of karst research in China, backed by the International Research Center on Karst and guided by earth system science, the lab is dedicated to improving karst dynamic theory, establishing experiment research platforms, and cultivating talented scientific professionals to make contributions to the goal of the International Research Center on Karst. The lab also conducts research on the influence of karst dynamic system on the global change, provides scientific and technologic solutions to ecological environment problems and presents innovative scientific solutions for the management of land and resources in karst regions.

In 2013, the lab published 1 monograph and 35 research papers, including 5 SCI-indexed and 2 EI-indexed papers. The lab was designated by the MST as the National Center for International Research on Karst Dynamic System and Global Changes.

Plaque “National Center for International Research on Karst Dynamic System and Global Change” unveiling

3 Key Laboratories Affiliated to the CGS and CAGS

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

We have basically established a crustal stress measurement network in the peripheries of Beijing and conducted measurements of crust stress not only within the Chinese territory, but also in overseas waters.

In 2013, 32 scientific papers were published with the lab as the first author, including 14 papers published in English and 8 in Chinese periodicals indexed by SCI/EI and the other papers published in China's core journals.

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

The laboratory is supported by the Institute of Hydrological and Environmental geology and focuses on the research for solutions to controlling and recoverying of groundwater pollution through applications of advanced groundwater recovery techniques imported from developed countries. At present, a research system was basically established, which is characterized by integrating the research of pollution mechanisms, investigation and evaluation of groundwater, development and application of groundwater recovery technology.

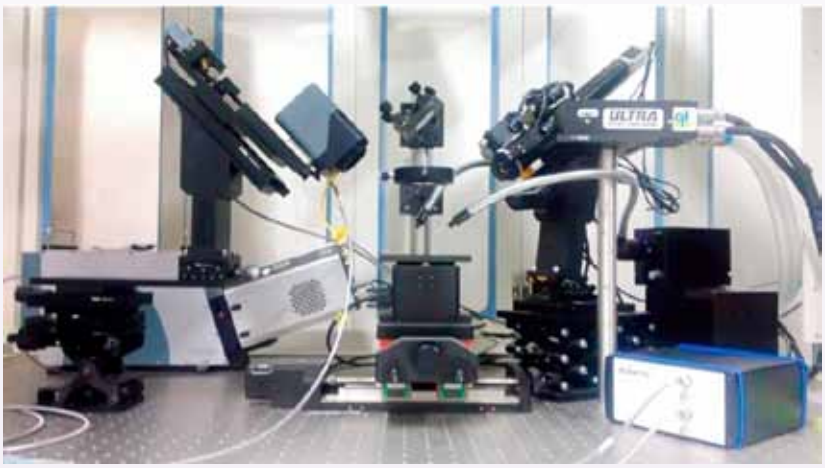
In 2013, the lab published 42 scientific papers, including 2 papers indexed by SCI, 3 by EI and 12 published in China's core journals.

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

The supporting institution of the laboratory is the National Research Center for GeoAnalysis, CAGS. With constructing a research platform for innovative microzone and morphologic analysis as the major task, the lab focuses on these research fields: developing microzone and morphological analytic methods for geological samples; finding out content, configuration, distribution and mode of occurrence of minor and trace elements on the nano-scale; studying morphologic distribution, migration and transform regularities of different elements from samples of typical mining areas in terms of element morphology

and their relations with microorganisms; exploring effective application of these methods to mineral prospecting and environment problems, with the view of providing technological support for geological and ore-searching purposes, comprehensive utilization of minerals and ecological research.

In 2013, the laboratory published 22 papers, including 10 papers in English journals and 1 in a Chinese journal with all indexed by SCI, 11 papers in China's core journals. Four projects received national patents for utility models.



In-situ laser-induced plasma spectrometer analytic system developed by the key lab

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

Supported by the Institute of Geophysical and Geochemical Exploration, CAGS. This laboratory mainly focuses on studying geochemical behavior and transport process of carbon and mercury under natural effect and in man-made interference process, ascertaining transport flux and control factors of various cycling processes in the earth's critical zone, evaluating ecological effect in the geochemical cycling process of carbon and mercury, carrying out research on soil carbon pool and carbon sequestration potential as well as geochemical evaluation on land quality in major farming zones, and providing scientific support for the rational utilization of land and environmental protection.

Dynamic monitoring system

A prediction model for soil carbon respiration and warming was established. The model also indicated that the carbon

released by soil organic carbon in red earth, meadow soil, cinnamon soil, moisture soil, boggy soil and black soil of our country was 519 Tg, equal to 31.7% of the release amount of solid fossil fuel burning of our country in 2010.

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

Supported by the Institute of Karst Geology, CAGS, this key laboratory was founded in 2012 at the Institute of Karst Geology. The research areas of the lab are as follows: investigation and risk assessment of karst collapse, formation processes and influence factors of karst collapse, monitoring techniques of potential sinkhole, karst collapse prevention and sinkhole remediation.

In 2013, 8 academic papers were published.

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

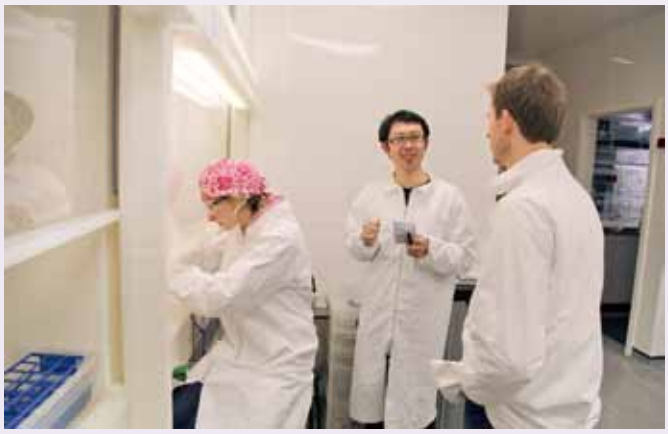
Supported by the Institute of Geomechanics, the laboratory is dedicated to research areas in the development and strategic targeting of special oil and gas resources, in particular, identification of shale gas. The lab conducts research on structural evolution and cumulative mechanisms of shale oil and gas, stress field and resources assessments and strives to build a scientific research base for assessment of shale oil and gas resources. With special oil and gas reservoirs as the core focus, four research directions have been set forth: structural evolution and distribution of oil and gas resources, shale oil cumulation mechanisms, geophysical explanation for shale oil and gas, and exploitation of shale oil and gas.

In 2013, 13 papers were published, including 8 in international journals and 5 in China's core journals, of which 5 papers indexed by SCI and EI. Two monographs, Oil Control of Structural Systems in Northwestern China and Oil and Gas Geomechanics, were published.

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

Supported by the Research Center for GeoAnalysis, 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.

In recent years, significant progresses have been made in the research of Re-Os isotope geochemical analysis for geological samples with high content of organic matter, providing a new technical approach to isotopic dating of sedimentary rocks, hydrocarboniferous rocks and oil and gas reservoirs.



Researchers from the lab visit Durham University, the UK

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

Supported by the Institute of Hydrological and Environmental Geology, this key laboratory focuses its research on revealing time series of paleoclimatic and paleohydrological evolution since the Quaternary, especially in the late Quaternary, in different sedimentary environments and at different time scales based on the research of geological records of climatic and environmental changes 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.

In 2013, 1 monograph and 5 research papers were published, including 2 papers indexed by SCI.

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

Supported by the Institute of Mineral Resources and Hefei University of Technology, 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 2013, 99 scientific papers were published, including 24 indexed by SCI and 8 by EI. The lab published 1 monograph and received 5 patents.

Chapter VII International Collaboration and Academic Exchanges

In 2013, 225 international cooperation and exchange opportunities were realized, including 152 for Chinese scientists and engineers travelling overseas and 73 in China with participants joining from other countries.

1 Steadily Promoting Major Bilateral and Multilateral Cooperation

(1) China-Germany Cooperation

(a) Cooperation with the Johannes Gutenberg University Mainz

On March 4, 2013, an inaugural ceremony was held at the Johannes Gutenberg University Mainz for the Germany-China Cooperative Research Center established jointly by the CAGS and the Johannes Gutenberg University Mainz. The Center addresses scientific fields ranging from primarily deep seas to deep-sea crust and even to more extensive interdisciplinary subjects, explores solutions to difficult issues in earth sciences through biological technology, and develops bio-medical materials and new natural products/chemicals.

Inaugural ceremony of the Germany-China Cooperative Research Center

On July 2, 2013, the CAGS delegation paid a visit to the Johannes Gutenberg University Mainz and the two parties held business talks, acknowledging the results obtained since they started their cooperation, and actively discussed the cooperation agreement to be signed.

Business talks between Wang Xiaolie, vice president of the CAGS, and Prof. Wolfgang Hofmeister, Vice President for Research, the Johannes Gutenberg University Mainz

(b) Cooperation with Potsdam University

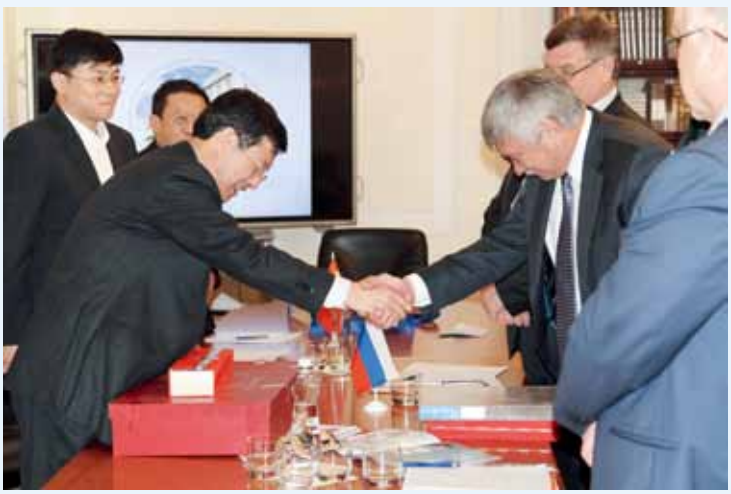
On July 1, 2013, vice president Wang Xiaolie and Prof. Patrick O'Brien, Dean of the Faculty of Science, the University of Potsdam signed the Cooperation Agreement between the CAGS and the University of Potsdam. They reached consensus on a series of issues such as enhancing cooperative research in earth sciences and training professionals in a cooperative way. In light of the Agreement, the CAGS has sent seven graduate students in two groups to attend field school organized by University of Potsdam on Tauern window in the Eastern Alps, Austria and field school on rock brittle deformation in St. Martin de Londres, southern France, so as to take the first step for conducting cooperation with European institutions of higher learning in teaching practice and academic exchange.

Teachers and students participating in a field geological trip in Austria

(2) China-Russia Cooperation

(a) Actively promoting high-level interaction between China and Russia

Entrusted by Vice Minister Wang Min, Vice President Dong Shuwen went to St. Petersburg, Russia on Sep. 29-Oct. 2, 2013 to attend the 35th General Meeting of EuroGeoSurveys and the International Conference "International Projects on Geological Study and Assessment of the Mineral Potential of the World's Largest Regions" organized by A. P. Karpinsky Russian Geological Research Institute (VSEGEI), during which bilateral talks were held among geologists from China and Russia on the cooperation in such fields as earth sciences and mineral resources.



Mr. Valery Pak, Head of the Federal Agency on Mineral Resources of Russia, receiving the delegation from China

(b) Further expanding the China-Russia operation into new fields

From June 26 to July 1, 2013, the delegation of the CAGS attended the International Conference on Unique Geosites of Russia: Conservation and Recreation Potential, in St. Petersburg, Russia, organized by the VSEGEI. During the meeting, the Chinese delegate actively promoted international exchanges and cooperation as regards geoparks between China and Russia.

(c) Steadily promoting bilateral cooperation projects

According to the working plan of the research on correlation of Permian volcanics provinces between China and Siberia, Liu Jianmin, senior researcher from the Institute of Geomechanics, CAGS and his two colleagues visited the VSEGEI on September 2-15, 2013, where they conducted test and analysis for the geological samples collected during the joint geological investigation in Norilsk, Russia.

(3) China-Australia Cooperation

On December 19, 2013, Vice President Dong Shuwen attended a meeting with visiting Prof. Paul Dirks, Head of the School of Earth & Environmental Sciences and Dr. Chang Zhaoshan, Director of the Economic Geology Research Centre (EGRU) from the James Cook University, Australia. They conducted a detailed discussion on extending academic exchanges between the two sides and reached agreement on the memorandum of understanding as regards their cooperation.

(4) Cooperation between China and African Countries

(a) From October 28 to November 12, 2013, the Training Course on Geoheritage Protection and Geoparks Construction was held by the Office of Global Geoparks Network (Chinese Geoparks

Opening ceremony of the training course

Network) affiliated to the CAGS with 15 trainees coming from 12 countries and regions in Africa.

(b) Vice President Wu Zhenhan and Prof. Abdel-Halim El-Nadi of the Department of Geology, University of Khartoum, Sudan had a meeting and discussed several potentials as future cooperation in geological research and investigation and joint training of doctoral and postdoctoral students.

2 Major International Cooperation Projects and International Conferences

(1) The Third Phase of the Five-party International Project of China, Russia, Mongolia, Kazakhstan and Korea proceeded smoothly

The eleventh working conference of the Five-country Cooperation Project was held in Irkutsk, Russia on September 1-5, 2013, at which the attending parties signed a summary of the conference and worked out a plan for the third phase (2013-2020) of the cooperative research.

During September 6-13, 2013, members of the Cooperation Project carried out joint geological investigation on the lithological composition, stratigraphic contacts and structural deformation characteristics of the Mongolian-Okhotsk structural belt.

(2) Publication of the International Geological Map of Asia (1∶5 M)

Under the aegis of the Commission for the Geological Map of the World (CGMW) and headed by Academician Ren Jishun, a cooperative project of the International Geological Map of Asia (1∶5 M) was carried out, which involved over 100 scientists from 4 subcommissions of the CGMW, as well as geological survey and research institutions from 20 Asian and European countries. This map was eventually published in October, 2013 by the Geological Publishing House of China.

(3) International Symposium on Karst Water under Global Change Pressure

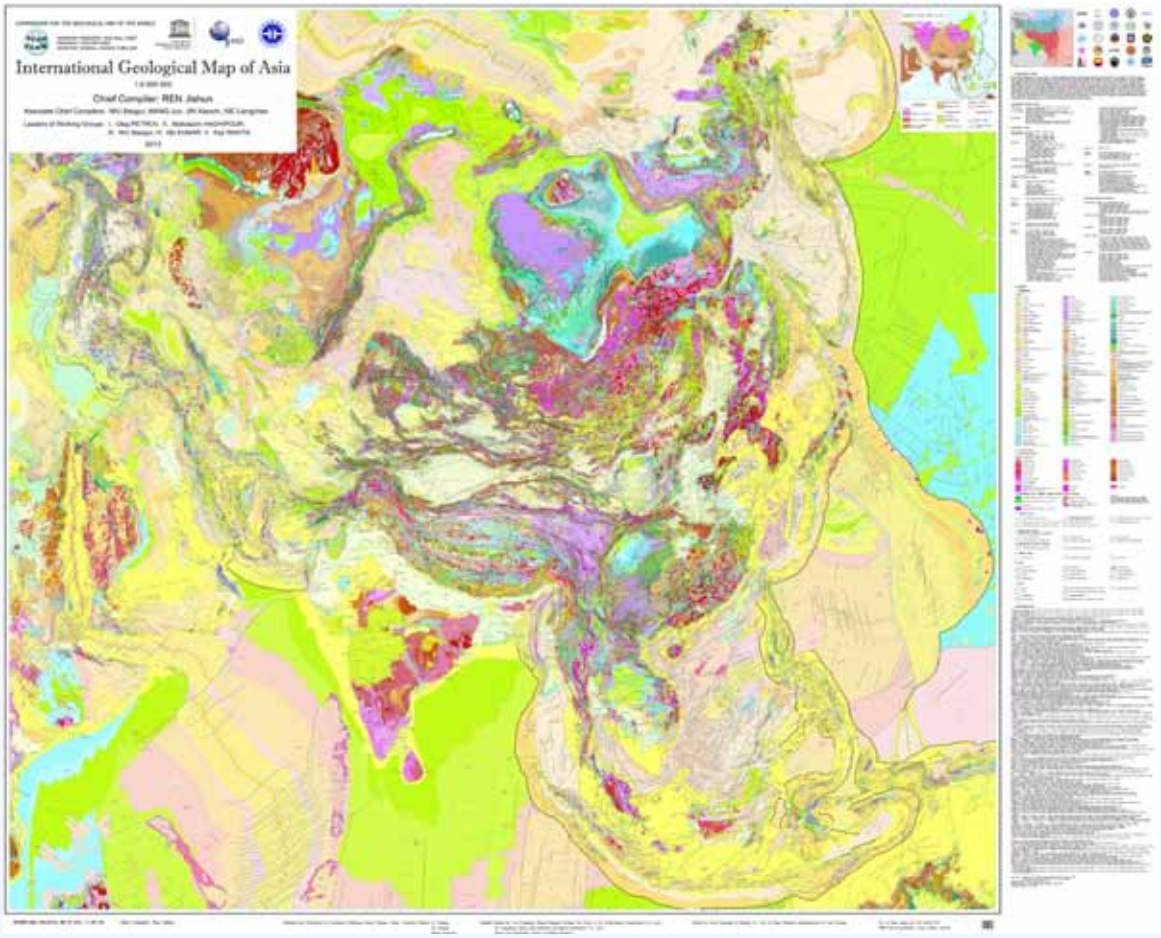
The symposium was organized by the International Research Center on Karst of the UNESCO and convened in Guilin, Guangxi Zhuang Autonomous Region from April 11 to 13, 2013. There were 138 participants from 13 countries, and 14 key-note speakers and 45 special lectures were presented at the symposium.

(4) Training Course on Mining Environmental Investigation and Rehabilitation for ASEAN Member Countries

A training Course was given in Kunmin, Yunnan Province on May 13-20, 2013. It was organized by the MLR and run by the Institute of Hydrogeology and Environmental Geology, CAGS. The training course was attended by 13 researchers from Vietnam, Thailand, Indonesia, Burma and Laos.

(5) The First Joint Scientific Meeting of the Geological Society of China and the Geological Society of America

Organized by the GSC and the GSA and operated by Chengdu University of Technology, the CAGS and



International Geological Map of Asia (IGMA5000)

the Chengdu Center of the CGS, the first Joint Academic Conference of the GSC and the GSA was held in Chengdu, Sichuan Province on June 17-19, 2013, focusing on the following topics: (1) evolution of the Qinghai-Tibet Plateau; (2) intracontinental deformation, mineral resources and geologic hazards; (3) environmental changes, biologic evolution, geochemistry and carbon sequestration. Altogether over 500 participants, including 160 overseas scientists, came from China and other countries. The GSC and the GSA have since then become partner societies.

(6) CGS-CCOP-ASEAN-IUGS Workshop on Geochemical Mapping

The workshop was run by the Institute of Geophysical and Geochemical Exploration and held in Nanning, Guangxi Province on September 3-8, 2013. The workshop had 24 trainees from Cambodia, Malaysia, Thailand, Vietnam, Laos, Mongolia, Papua New Guinea and the Philippines.

A group photography of the workshop

(7) International Meeting on Precambrian Evolution and Deep Exploration of the Lithosphere

Organized by the Institute of Geology, CAGS and Beijing SHRIMP Center, this meeting was held in Beijing on October 7-9, 2013 and attended by 150 scientists from 14 countries, including some 50 overseas participants, and about 60 research papers were presented at the meeting.

3 Cooperation with International Organizations

(1) Cooperation with the UNESCO

(a) A visit to the UNESCO

On June 27, 2013, Wang Xiaolie, Party Committee Secretary of the CAGS, and his delegation paid a visit to the Headquarters of the UNESCO and had talks with Dr. Gretchen Kalonji, Assistant Director-General for Natural Sciences at UNESCO, and relevant officials. They exchanged each others' opinions on topics of common concern such as the IGCP and the initiative about geoparks put forward by the UNESCO, and reached consensus on many issues. Mr. Tian Zhong, First Secretary, Permanent Delegation of the People's Republic of China to UNESCO, was also present on this occasion.

(b) Cooperation with the International Research Center on Karst (IRCK)

(i) On November 25-26, 2013, the UNESCO approved the evaluation for the construction of the IRCK

during the first six-years phase. It was confirmed that the IRCK had become a high-efficiency second-type research center of the UNESCO.

(ii) On September 29, 2013 the MST designated the National Center for International Research on Karst Dynamic System and Global Change as a State-level international research center, which is backed by the Institute of Karst Geology, CAGS and IRCK.

(iii) Reelection was completed for the new term of the Second Council and the Academic Committee of the IRCK at the fourth meeting of the First Council and the third meeting of the First Academic Committee held on December 4 and 6, 2013, respectively. Vice Minister Wang Min remained at the post of Council Chairman and Academician Yuan Daoxian continued to be Chairman of the Academic Committee.

(iv) On November 17-29, the fifth International Training Course on Karst Hydrogeological Investigation, Dynamic Monitoring and Application in River Basin, organized by the IRCK was held in Guilin, Guangxi. The training course was taken by 21 researchers from 18 countries including Brazil and Nigeria.

(c) Approval of the establishment of the International Center on Global-scale Geochemistry under the UNESCO

The 37th Assembly of the UNESCO held on November 13, 2013 approved the establishment of the International Center on Global-scale Geochemistry at the Institute of Geophysical and Geochemical Exploration, CAGS in Langfang, Hebei Province. The research center is dedicated to fulfilling the following objectives: conducting study on the global-scale content and distribution, and baseline and variation for all elements and the compounds in the Periodical Table of Elements with a view to providing basic knowledge and data for comprehensive understanding of the distribution of global resources and the change of global environment, and providing a basis of policy decisions for the Government in global sustainable development of mineral resources and ecological environment, so as to foster knowledge sharing among developed and developing countries.

(2) Cooperation with the IUGS

The CAGS took up the routine work of the Permanent Secretariat of the IUGS after this international geological organization moved to China in December, 2012. They organized the 66th meeting of the Executive Committee of the IUGS, and the working conference of the Executive Bureau and the IUGS Exhibition during the conference marking the 125th Anniversary of the GSA. The other work that was done during this period includes updating the database of contacting information, developing the information management system of the IUGS and putting it into use, and drafting the 2012 Annual Report of the IUGS.

The booth of the IUGS set up by the Secretariat during the conference marking the 125th Anniversary of the GSA

(3) Award issued by International Organizations

Prof. Dong Shuwen, Vice President of the CAGS, received a title of Honorary Fellow of the Geological Society of America.

4 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	Academician	since 2011
	Geological Society of America (GSA)	Honorary Fellow	since 2013
He Shiyi	Commission on Karst Geology, IAH	Member	since 2009
Hou Zengqian	Society for Geology Applied to Mineral Deposits (SGA)	Regional Vice-President	2011-2013
	Resources Geology	Senior Editorial Board Member	since 2009
Ji Qiang	Asia Dinosaur Association	Vice President and Secretary General	since 2013

Continued

Name	Academic Organization or International Journal	Position	Term
Jiang Guanghui	Commission on Karst Geology, IAH	Co-Chair	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	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
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
	Society of Economic Geologists (SEG)	Councilor	2013-2016
Nie Fengjun	*Resource Geology*	Senior Editorial Board Member	since 200
	Scientific Board of the International Geoscience Programme (IGCP), UNESCO	Member	2009-2016
	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
Sun Ping	*Landslides*	Editorial Board Member	since 2009
Wang Jun	Commission on Management and Application of Geoscience Information, IUGS	Observer	since 2010

Continued

Name	Academic Organization or International Journal	Position	Term
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 1999
	Journal of Geochemical Exploration	Editorial Board Member	since 1999
	Geological Society of America (GSA)	Fellow	since 2011
	Mineralogical Society of America (MSA)	Fellow	since 2009
Yang Zhenyu	Publications Committee, IUGS	Member	2011-2014
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, IAEG	Member	since 2008
Zhang Cheng	Commission on Karst Geology, 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, 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 Xiangkun	Commission on Isotopic Abundances and Atomic Weights (CIAAW)	Titular Member	2010-2014

Chapter VIII Graduate Education and Postdoctoral Work

Graduate and postdoctoral education of the CAGS assumes a task to cultivate high-caliber professionals in geosciences.

1 Graduate Education

The enrollment plan of the CAGS in 2013 approved by the Ministry of Education is as follows: 75 graduate students including 35 Ph.D candidates and 40 studying for a master's degree; 76 graduate students trained by the CAGS and other universities or colleges, including 36 Ph.D candidates with an increase of 16 over 2012 and 40 students for a master's degree. In 2013, one more university, China University of Geosciences (Wuhan), was entitled to train graduate students in conjunction with the CAGS.

In 2013, altogether 361 graduate students studying in the CAGS; 63 Ph.D candidates and 80 students for a master's degree were newly enrolled; 30 doctoral and 34 master students completed their courses and 31 students were conferred doctorates and 34 received master's degrees. While studying in school, 64 students published 189 research papers as the first authors in Chinese and international academic periodicals, including 30 papers indexed by SCI (8 papers in international journals) and 17 papers indexed by EI.

The CAGS organized two groups of graduate students for the first time to take field geological courses at University Potsdam of Germany during the summer vacation period.

Specialized subjects for the enrollment of graduate students in 2013

In 2013, graduates were enrolled in 64 research directions of 8 specialized subjects for doctorate and 80 research directions of 11 specialized subjects for master's degree conferral. Specifically, the specialized subjects are as follows: (1) analytic chemistry; (2) solid-earthy physics; (3) mineralogy, petrology and study of ore deposit; (4) geochemistry; (5) paleontology and stratigraphy; (6) tectonic geology; (7) Quaternary geology; (8) mineral reconnaissance and exploration; (9) earth probing and information technology; (10) geological engineering; (11) mineral processing engineering.

Graduate students of the CAGS conducting field practice and taking courses in Zhucheng, Shandong Province

The first academic annual meeting of graduate students of the CAGS

2 Awards and Degrees Conferred on Graduate Students

Five students won the Cheng Yuqi Award for Outstanding Graduates Student, 5 students received the Cheng Yuqi Award for Excellent Degree Theses, and 1 student won the Li Siguang Award for Outstanding Master Students.

Sixteen students were granted national scholarships for the period of 2012-2013, 10 students were commended as outstanding graduates by relevant Beijing municipal departments and the CAGS, and 28 students received the honorary title of "Merit Student".

Academician Li Tingdong confers a degree on a graduate student

Graduation ceremony

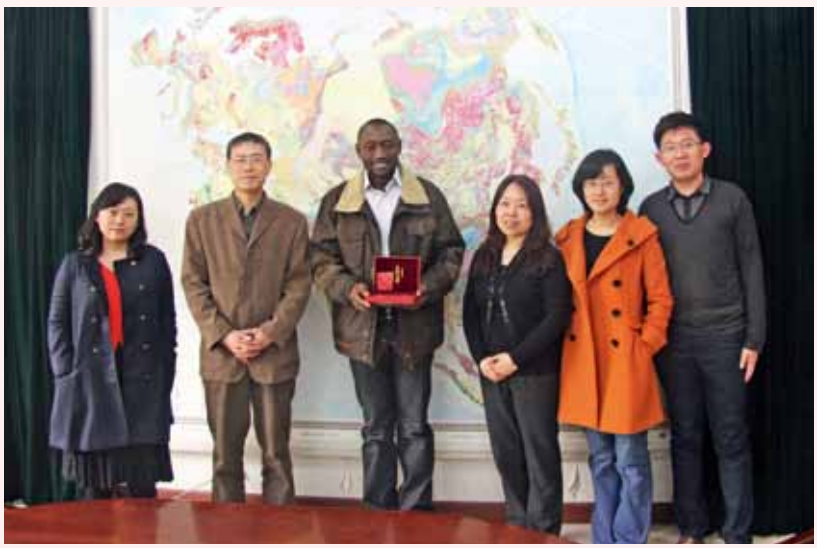
A group photo of graduate students who finished school in 2013

3 Postdoctoral Education

At present there are 2 postdoctoral fellows programs in the CAGS: one is engaged in geology and the other in geological resources and geological engineering. In 2013, 30 postdoctoral fellows were recruited in the programs, including one from Africa. There were 103 members at the research programs and 3 of them received financial assistance from the National Natural Science Foundation of China.

In 2013, 14 postdoctoral fellows had left the programs after finishing their research work, of whom 10 went back to their original institutions, while 4 joined other organizations. These researchers have, as first authors, published 26 scientific papers indexed by SCI, and have undertaken 38 research projects.

Postdoctoral fellows have their alumni association



The research program receives a postdoctoral fellow from Africa

Chapter IX Major Activities in 2013

1 Minister Jiang Daming and His Colleagues Visited the CAGS

On June 4, 2013, Minister Jiang Daming and Vice Minister Wang Min, also Director-General of the CGS, and their colleagues, accompanied by leading officials of the MLR and Wang Yan, Deputy Director-General of the CGS, visited CAGS. They first visited the State Key Laboratory of Continental Tectonics and Dynamics, MLR Key Laboratory of Metallogeny and Mineral Resource Assessment, and Centre of Deep Exploration. Then, there was a town-hall meeting with the CAGS management and leading scientists. Jiang Daming and other visitors first listened to a work report given by Vice President Wang Xiaolie on behalf of the CAGS Party Committee and communicated with eleven academicians including Li Tingdong, Chen Yuchuan and Yuan Daoxian. In his speech, Jiang Daming spoke highly of excellent work performed at the Academy and stressed the leading role of the CAGS in the national strategic direction of innovation-driven developments in geological science and resource exploration. Vice Minister Wang Min chaired the meeting.

Panel discussion

Minister Jiang Daming and his colleagues visiting the State Key Laboratory of Continental Tectonics and Dynamics, MLR Key Laboratory of Metallogeny and Mineral Resource Assessment, and Centre of Deep Exploration on June 4, 2013

Leaders of the MLR confer outstanding achievements prizes of the CAGS Xinhualian Science and Technology Award at the Second Award Ceremony

2 CAGS Working Conference of 2013 Held in Beijing

On January 21, 2013, the CAGS held the 2013 working conference in Beijing. Deputy Director-General Wang Yan, entrusted by Wang Ming, Vice Minister of the MLR and Director-General of the CGS, attended the conference and made a speech. Vice President Wang Xiaolie, on behalf of the senior management of the CAGS, delivered a report entitled "Address challenges and work hard to advance geological sciences and technology innovation".

The 2013 working report of the CAGS put forward new ideas about our work in the latter three years of the Twelfth Five-year Plan period: to continue our efforts to build the CAGS into a world-class scientific institution; deepen reforming of the science and technology management system and develop modern geological science and technology; integrate geological science and technology to make breakthroughs in mineral exploration, ecological improvement and environment protection, and economic development; to advance in building exceptionally talented workforce, improving innovative infrastructures, and cultivating a culture of innovation. The detailed plans were documented in the 2013 work report of the CAGS.

Working conference

Deputy Director-General Wang Yan confers awards to the 2012 Top-10 scientific and technological advances of the CAGS

3 The 2012 Annual Report Conference of SinoProbe Program

On April 16-18, 2013, an annual conference was successfully held in Beijing for reporting and discussing major accomplishments achieved by the first phase "Deep Exploration Technology and Experiment" of the SinoProbe program preparation phase in 2012. Vice Minister Xu Deming, MLR, delivered an important speech and Ding Zhongli, Vice President of the Chinese Academy of Sciences, also attended the conference.

Scientists in the conference presented and discussed major advances of the SinoProbe program over last five years in major areas of deep exploration such as understanding of the earth's interior, exploration equipment, discoveries of resources, geochemical studies, and geological hazards mitigation.

Vice Minister Xu Deming pointed out that successful implementation of the SinoProbe has marked breakthroughs in advances of basic research in earth science and technological innovation in China. Xu also said that China is now ready to launch the full scale of the SinoProbe program: the "Crustal Exploration" Project. The MLR will further revise the official proposal of the full scale of the SinoProbe program and submit the proposal to the review process of the national premier science and technology projects with the hope of earliest possible approval of funding to address the national critical issues in basic earth science research, natural resources and environment and geological hazards.

SinoProbe 2013 Annual meeting

Present in the conference were representatives from the National Development and Reform Commission, Ministry of Finance, Ministry of Education, Ministry of Science and Technology, Chinese Academy of Sciences, Chinese Academy of Engineering, China Earthquake Administration and National Natural Science Foundation of China, as well as leading officials of relevant departments of the of MLR and other public institutions in addition to academicians, experts and researchers of the SinoProbe program.

Vice Minister Xu Deming observing equipment displayed

Vice President and SinoProbe PI Dong Shuwen presiding at the SinoProbe

4 Activities on the 44th World Earth Day

The 44th World Earth Day on April 22, 2013 was celebrated at the CAGS with the main theme of "Cherishing earth's resources and transforming the style of economic development dash building an environment friendly and ecological civilized China". Various activities were arranged at the CAGS such as opening of all key labs, memorial halls and museums to the public for visiting on the Earth Day, distributing materials and CDs for outreach education in earth science and deep exploration. The Graduate School also planned activities focusing on the theme of the Earth Day to enhance public awareness of cherishing natural resources, protecting ecological environment and ensuring scientific development.

Young Pioneers from the Li Siguang Squad of the Zhanlanlu Primary School

A scientist explaining laboratory apparatus to Young Pioneers

Young Pioneers attending a class at the Centre for Deep Exploration

Young Pioneers experiencing 3D demonstration at the Three-dimensional Geological Survey and Research Center

Chapter X Academic Publications

In 2013, 958 research papers were published in academic periodicals by the CAGS scientists, an increase of 5.4% over the previous year, including 225 SCI-indexed and 81 EI-indexed papers, and 446 papers were published in China's core journals. In addition, twenty one monographs were published.

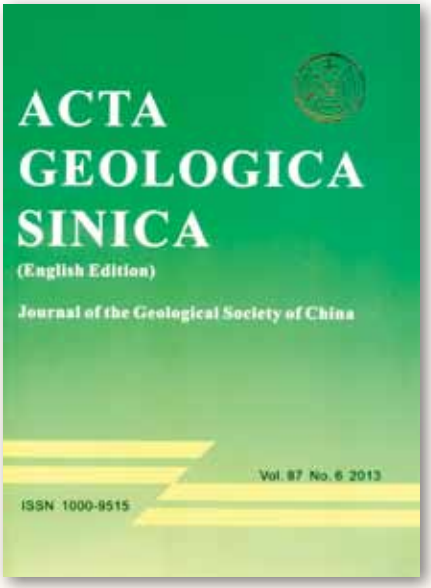
The CAGS and the GSC, whose administrative office is at the CAGS, are sponsoring 9 academic journals, including *Acta Geologica Sinica* (English edition) (indexed by SCI), *Acta Geologica Sinica* (Chinese edition), *Mineral Deposits, Carsologica Sinica, Acta Geosceintica Sinica, Acta Mineralogica et Analytica* (indexed by CA), *Acta Petrologica et Mineralogica, and Journal of Geomechanics* (China's core journal).

In 2013, *Acta Geosceintia Sinica* was for the first time indexed by EI. *Acta Geologica Sinica* (English edition), *Geological Review, Mineral Deposits, Acta Geoscientica Sinica and Acta Petrologica et Mineralogica* were chosen as journals among the "academic periodicals of the highest international impact in China of 2013".

Supported by the funds from the CAGS's basic research expenditures and the Project of Outstanding S&T Journals launched by the China Association for Science and Technology (CAST) and based on the above nine journals, notable progress was made in 2013 in digitalization of scientific journals in earth science: the development of the On-line Management System for Scientific Journals was proceeding smoothly. The website of geoscientific journals of China (http://www.geojournals.cn/) had proven to be most active and heavily used, and more professional periodicals covered than any other geoscientific websites in China. The website had more than 2 million hits and drew extensive attention of researchers from more than 10 other countries such as the US, Japan, Germany, the UK, Australia, Canada, Russia, Poland and Mongolia, and the monthly click rate was up to 5,000.

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. 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). During 2006-2011, the magazine received financial aid for six consecutive years from the Project of A-category Outstanding Periodicals of the CAST, and was supported as the

first-prize winner of the Best International Scientific Journals Award (2012-2014) given by 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. In 2013, *Acta Geologica Sinica* (English edition) published 6 issues (1746 pages in total), carrying 132 scientific papers including 27 overseas papers (20.5%). The impact factor was 1.57 in 2012, taking the first place among all geoscientific magazines in China.



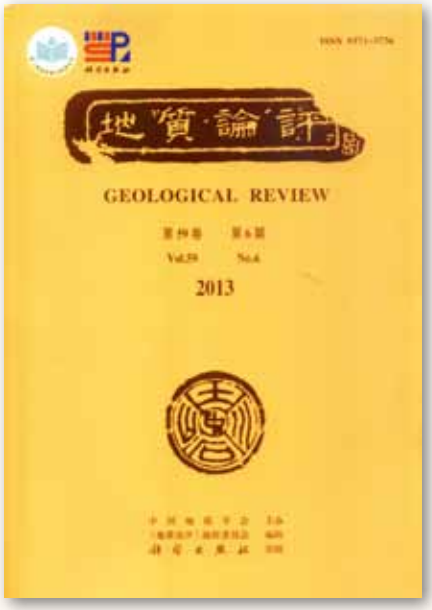
Website: http://www.geojournals.cn/dzxbcn/ch/index.aspx/

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. The journal has been praised several times by the MST, PDCPC and GAPP and won the National Journal Award in 2005. During 2006-2010, it received financial aid for five consecutive years 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. In 2013, 160 scientific papers (1952 pages in total) were published in *Acta Geologica Sinica* (Chinese edition) and more than half of the papers were financially supported by major research projects, such as Project 973 and the National Natural Science Foundation of China. In addition, a special issue on isotope was published, which is of significance in promoting scientific development in this study field. The impact factor of the journal was 2.077 in 2012 and the total number of citations was 4,574. The impact factor and the number of citation were ranked fourth and third respectively among the geoscientific journals in the mainland of China, with the cited half-life being greater than 10.

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

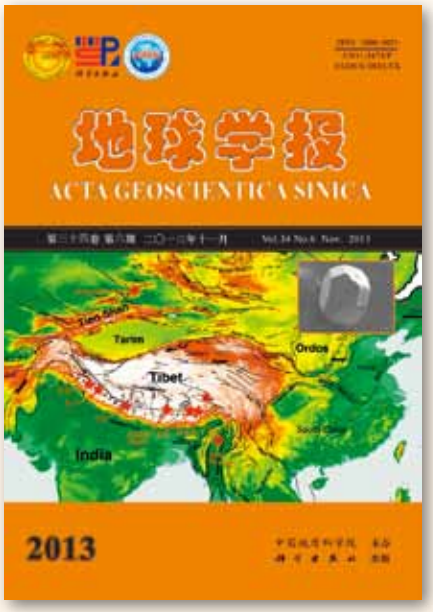
GEOLOGICAL REVIEW is sponsored by the GSC and started publication in 1936. The journal has long seen its mission as stimulating scientific debate and discussion as well as encouraging the

exchange of ideas and research discoveries. *Geological Review* is a bimonthly journal and 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. The journal was chosen among the Project of Outstanding S&T Journals of the CAST in 2006, and appraised as a journal among the Top-notch Academic Journals of 100 Categories by the Institute of Scientific and Technological Information of China in 2009. In 2013, over 100 scientific papers were published in *Geological Review* in addition to more than 10 news releases. The impact factor was 1.50 in 2012 and the total number of citations was 3,044.



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

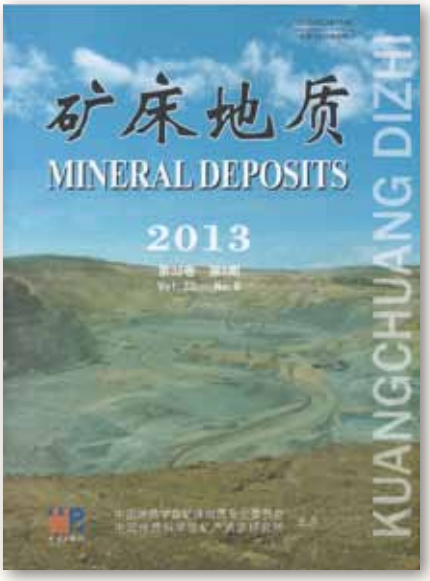
ACTA GEOSCIENTICA SINICA is a bimonthly journal sponsored by the CAGS and published by the Science Press. It is among China's core scientific journals, national core journals of natural science and national Chinese core journals. It is a source periodical for the statistics of Chinese scientific papers, 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 cites higher than 100. it was indexed by EI and became the source item of EI. In 2012, the core impact factor was 2.115 and the total number of cites was 2,099.



As an important window for showing a fine academic image of the CAGS, *Acta Geoscientica Sinica* is dedicated to full report of the academic archivements and overall competitiveness of the CAGS in scientific research. In 2013, six issues (770 pages) were published, carrying 86 scientific papers and 26 various newsletters, in addition to a supplementary issue with 235 pages of 35 papers.

Website: http://www.cagsbulletin.com/dqxbcn/ch/index.aspx

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*, CNKI, CSCD and CJFD.

In 2013, 95 scientific papers were published in *Mineral Deposits*. The journal has maintained a high number of papers reporting national funded research projects compared with other scientific periodicals in China. The impact factor was 1.779 in 2012, taking the fourth place among the journals in earth science and the fifteenth place among all scientific periodicals of 1994 categories in China. The core impact factor was 2.595 and the total number of cites was 3372. 20 papers published from 2007 to 2012 were chosen as top-notch papers of the outstanding science and technology journals of China.

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

ACTA PETROLOGICA 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 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 Mineralogica* is the source item of a number of index systems and digests in both China and abroad, and is included in website CEPS of Taiwan, AJ, BIG, CA, GEOREF and CSA of foreign countries and some Chinese databases such as the CNBKCY (natural science and technology), China Geological Literature Database System and China Citation Database.

Acta Petrologica Mineralogica published 103 scientific papers in (1,066 pages) in 2013. Its website has more than 1,600 pageviews averagely a day with an increase of some 40% compared with the previous year. In 2012, the journal had an impact factor of 1.075, the total number of citations of 1,334 and a non-self-citing rate of 0.94, showing high ranking among the journals of the same scientific field.

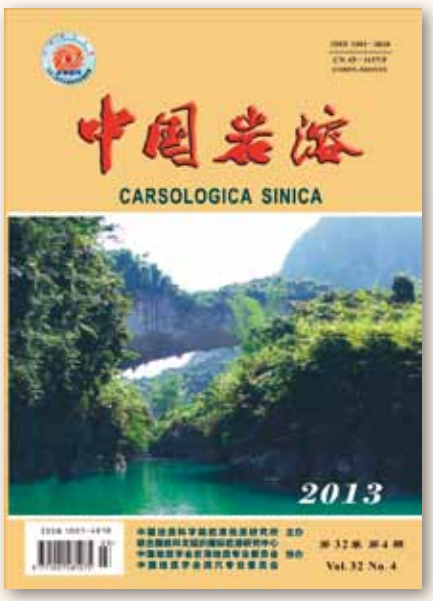
Website: http://www.yskw.ac.cn/

ROCK AND MINERAL ANALYSIS is sponsored by the Commission on Rock and Mineral Analysis of the GSC and the National Research Center for GeoAnalysis, and has been published since 1982. This is the only scientific periodical in China that is related to geoanalysis and reflects the level of geoanalysis of China.

This journal persists in "zero tolerance" for any academic misconduct, and has arranged training classes and business exchanges to the authors from time to time. The entire procedure from submission to publication of manuscripts is now managed through an online process. In 2013, more papers were published compared with previous years and progress was made in raising the academic reference value, overall quality and core competitiveness of the journal. Altogether 330 manuscripts were received and 24-30 papers (142-180 pages) appeared in each issue. *Rock and Mineral Analysis* was received by Index of Copernicus (2011), listed in the front rank of the Chinese journals of 579 categories, and 558 papers were indexed by SCI-E. In 2013, the journal had 3924 subscribers including high-end international institutions, universities and government departments, such as University of Oxford, the Ministry of Defense of France and the Library of Congress of the United States. The impact factor was 1.37 and the total number of citations was 1,636.

Website: http://www.ykcs.ac.cn/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 2013, carrying 66 scientific papers (487 pages). The journal has the impact factor of 0.884 and total number of citations was 920.

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

JOURNAL of GEOMECHAMICS is an academic journal sponsored by the Institute of Geomechanics, CAGS and 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 trend 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 regularities 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, China Citation Database, Chinese Core Periodicals (Evaluation) Database and CJFD of the CNKI. Altogether 44 research papers (446 pages) were published in 2013. The citation rate and influence of this journal are both increased year by year. The impact factor was 1.013 and the total number of citations was 558 in 2012.

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