INSTITUTE OF GEOLOGY CHINESE ACADEMY OF GEOLOGICAL SCIENCES

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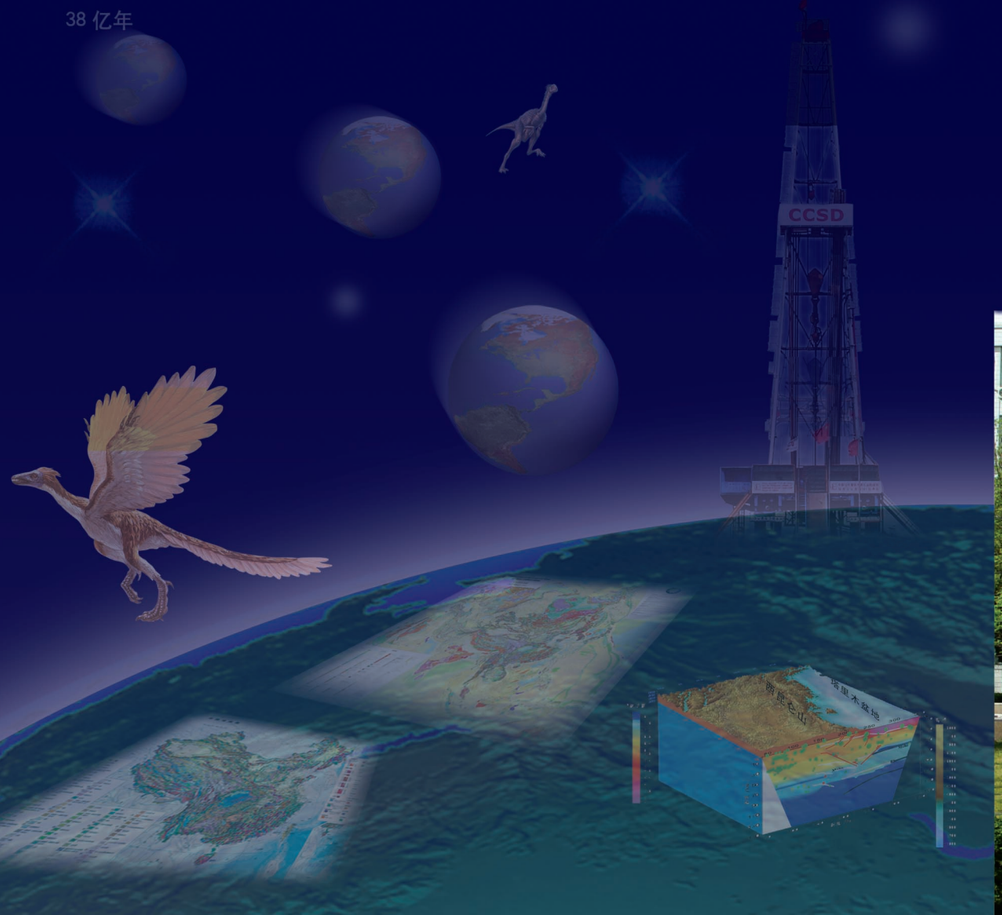
Annual Report 2014

Institute of Geology
Chinese Academy of Geological Sciences
(CAGS)



Editorial Committee

Contents

Preface

The Institute of Geology, Chinese Academy of Geological Sciences (CAGS), is a national public scientific research institution and is mainly engaged in national fundamental, public, strategic and frontier geological survey and geoscientific research. Entering the new century, and in particular during the past 5 years, the Institute has made notable progress in scientific research, personnel training and international cooperation, with increasing cooperation and exchange activities, expanded fields of cooperation, abundant output of new research results, and an increased number of papers published in "Nature", "Science" and other high-impact international scientific journals. In the light of this new situation and in order to publicize, in a timely manner, annual progress and achievements of the Institute to enhance its international reputation, an English version of the Institute's Annual Report has been published since 2010.

Similar to the previous reports, the Annual Report 2014 includes the following 7 parts: (1) Introduction to the Institute of Geology, CAGS; (2) Ongoing Research Projects; (3) Research Achievements and Important Progress; (4) International Cooperation and Academic Exchange; (5) Important Academic Activities in 2014; (6) Postgraduate Education; (7) Publications. In order to avoid confusion in the meaning of Chinese and foreign names, all family names in this Report are capitalized.

We express our sincere gratitude to colleagues of related research departments and centers of the Institute for their support and efforts in compiling this Report and providing related material – a written record of the hard work of the Institute's scientific research personnel for the year 2014.

Editorial Board of
the Annual Report (English Version) of the Institute of Geology,
Chinese Academy of Geological Sciences
23 May 2015

1. Brief Introduction to the Institute of Geology

The Institute of Geology, Chinese Academy of Geological Sciences (CAGS), was formally established in April 1956 but can be historically traced back to the former Central Geological Survey as early as the 1910s. As a national public scientific research institution, the Institute of Geology is an integral part of the national scientific and technological innovation system, providing technological support for national geoscientific research and investigation of geology and mineral resources. The Institute is mainly engaged in national, fundamental, public, and strategic geoscientific frontier research and basic geological survey. It is one of the important national research bases in the solid earth sciences, the application of earth science-related technologies, and the education of young geoscientists.

Since its establishment in the 1950s, the Institute has made considerable contributions to national economic growth by providing scientific and technological advice to major issues of social relevance such as resources, environmental protection, and large-scale construction projects. The Institute has also won recognition in theoretical advances in the geosciences by means of basic research in frontier disciplines. In the Institute, 17 geoscientists, such as HUANG Jiqing, XIE Jiarong, SUN Yunzhu, CHENG Yuqi, LI Chunyu, etc., were elected Academicians of the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE). With its competitive research team and remarkable scientific achievements, the Institute strives to enhance its domestic and international status in the geoscientific community.

The Institute currently has 251 staff, including 6 Academicians, 61 Research Fellows, and 53 Associate Research Fellows. 157 researchers earned their doctoral degrees, and 32 earned their master degrees. Amongst the Senior Researchers there are 34 advisers of doctoral candidates and 30 advisers of master candidates.

By the end of 2014, the Institute had won 160 science and technology awards at national, provincial and ministerial levels, among which were 24 prizes of the National Science Conference Award, 11 prizes of the National Natural Science Award and the National Science and Technology Progress Award (2 first prizes, 5 second prizes, 3 third prizes and 1 fourth prize), 125 prizes of the Science and Technology Progress Award at the Provincial and Ministerial levels (13 first prizes, 42 second prizes, 56 third prizes and 14 fourth prizes). More than 3000 research papers and 120 monographs were published since 1981. Since 1991, 4 researchers of the Institute have won the Prize for Scientific and Technological Achievement and the Prize for Scientific and Technological Progress of the Ho Leung Ho Lee Foundation, 6 researchers have won the J. S. Lee Honorary Prize for Geoscience, and 5 researchers have won the National Science Fund for Distinguished Young Scholars.

Fig. 1. Main building of the Institute

Organizational framework

The structure of the Institute is as follows:

Administrative Departments

General Office

Science and Technology Department

Service and Security Department

Financial Department

Personnel and Education Department

Research Divisions

Division of Regional Geology and Mapping

Division of Tectonics

Division of Stratigraphy and Paleontology

Division of Metamorphic Rocks and Precambrian Geology

Division of Igneous Rocks

Laboratory of Continental Dynamics

Laboratory of Isotope Geology

Lithosphere Research Center

Beijing SHRIMP Center

Mineral and Energy Resources Center

Three-dimensional Geological Survey and Research Center

Key Laboratories

Key Laboratory of Isotope Geology, Ministry of Land and Resources

Key Laboratory of Stratigraphy and Paleontology, Ministry of Land and Resources

Key Laboratory of Earthprobe and Geodynamics, Ministry of Land and Resources

National Research Centres

State Key Laboratory of Continental Tectonics and Dynamics

Beijing SHRIMP Center

Technical Support Organizations

Commission for the Geological Map of China (CGMC)

Center for Stratigraphy and Paleontology, China Geological Survey

Affiliated Academic Organizations

China Commission of International Continental Scientific Drilling

Commission of Regional Geology and Mineralization, Geological Society of China

Commission of Geological Mapping, Geological Society of China

Commission of Stratigraphy and Paleontology, Geological Society of China
Commission of Petrology, Geological Society of China
Commission of Isotope Geology, Geological Society of China
Commission of Metamorphism, Mineralogy and Geochemistry, Geological Society of China

Peer-reviewed Publication

Acta Petrologica et Mineralogica

Research Fields

Regional geology, mapping and related database construction
Regional and global tectonics
Origin and evolution of life, paleontological and stratigraphic correlation
Precambrian geology and early crustal evolution
Cenozoic geology and modern geological and ecological environments
Ultrahigh pressure metamorphism and metamorphic belts
Petrology, mineralogy, and earth materials science
Continental dynamics and mantle dynamics
Geological setting of mineralization and regional mineralization
Deep geophysical probing, lithospheric structure and geodynamics
Isotope geology theory, methods and applications
Quaternary geology and past global changes

2. Ongoing Research Projects

There were 184 ongoing research projects in the Institute in 2014 as listed below.

2.1 Projects funded by the National Natural Science Foundation of China

Key Projects:

No.	Chief Investigator	Project	Duration	E-mail address
1	JIAN Ping†	Geochemistry and chronology of ophiolites distributed in eastern Junggar, Xinjiang and central-south Mongolia	2011-2014	jianping@bjshrimp.cn
2	XU Zhiqin	Continental dynamics and resource effects of the Qinghai-Tibet Plateau	2013-2015	xzq@ccsd.cn
3	ZHANG Zemin	Metamorphism and tectonics of the eastern Himalayan orogen	2013-2017	zzm2111@sina.com
4	HOU Zengqian	Comparison of the main metallogenesis of the Himalayan-Zagros collisional orogenic system	2014-2018	houzengqian@126.com
5	LI Haibing	Fault friction over time: co-seismic weakening and post-seismic healing inside the Wenchuan Fault	2014-2018	lihaibing06@163.com

†deceased April 2015

General Projects:

No.	Chief Investigator	Project	Duration	E-mail Address
1	MENG Fancong	Genesis of jadeitite from the Polar Urals, Russia	2011-2014	mengfancong@yeah.net
2	HUANG Hao	The paleobiogeography of Permian fusulinids in the Baoshan Block, Yunnan, SW China	2012-2014	hh1936@163.com
3	CHEN Songyong	Genesis and tectonic implications of eclogites in the Songduo terrane, Lhasa, Tibet	2012-2014	chensongyong@163.com
4	HE Zhenyu	Petrogenesis of vast volcanic-intrusive complexes in the coastal Zhejiang-Fujian area: insights from case studies	2012-2014	ahhzy@163.com
5	LIU Jianfeng	Tectonic setting of Permian volcanic rocks from the southern segment of the Great Xing'an Range	2012-2014	wenjv@aliyun.com
6	YANG Hong	Genesis of barite in eclogite from the main-hole of the CCSD and its indication of fluid exsolution in a continental subduction zone	2012-2014	yang-pku@126.com
7	YONG Yong	Chronology and petrochemistry of the Yushu ophiolite	2012-2014	yongyy@139.com
8	ZHANG Lei	Genesis of the Shuangyashan Cenozoic basalt in Heilonhjiang Province and its mantle origin	2012-2014	windprint@gmail.com

9	LIU Yan	Xuebaoding Leucogranites in northwestern Sichuan Province and their W-Sn-Be deposit forming mechanism	2012-2014	ly_0620@126.com
10	ZHANG Hongrui	Internal structure of reverse fault and its control on the formation of hydrothermal deposits in the shallow crust: A case study from the Domozhazhua Pb-Zn deposit, north-central Tibet	2012-2014	hongrui_1982@126.com
11	LIU Jianhui	Cenozoic uplift and exhumation history of the North Qinling Range: Constraints on the temporal and spatial evolution of Cenozoic intracontinental extension in the North Qinling Range-Weihe Graben	2012-2014	liujianhui1999@163.com
12	SI Jialiang	Research on clay minerals and fluid-rock interaction along the surface rupture zone of the Wenchuan earthquake	2012-2014	yazhousi@126.com
13	XIANG Zhongjin	Source and tectonic setting of Silurian volcanism in the northern Daba Mountains, China: evidence from pyroclastic rocks	2012-2014	jing19851001@163.com
14	XIONG Xiaosong	The Moho variation and the shallow response from the Huayingshan to Xuefengshan tectonic belt in South China	2012-2014	benxung@126.com
15	HOU Hesheng	Shallow-deep structural relationships between the northern margin of North China Craton and the southern margin of Xing'an-Mongolia Orogenic Belt as revealed by deep seismic reflection profiles	2012-2014	hesheng.hou@126.com
16	TANG Feng	The evolution and biostratigraphic significance of typical Ediacaran macroscopic fossil assemblages in southern China	2012-2015	tangfeng@cags.ac.cn
17	LIU Penjv	Biostratigraphical division of acritarchs from the Ediacaran Doushantuo Formation in the Yangtze Gorges and their international correlation	2012-2015	pengju@cags.ac.cn
18	CHI Zhenqing	Study of the criteria for Pleistocene-Pliocene division in the Nihewan Basin, Hebei Province	2012-2015	zqchi@263.net
19	DU Lilin	A 2.2-2.0 Ga geologic event in the Wutai and Zhanhuang areas, central North China craton, and its tectonic features	2012-2015	dulilin7310@cags.ac.cn
20	WAN Yusheng	Formation and evolution of the Archean granite-greenstone belt in western Shandong: Geology, geochemistry and zircon dating	2012-2015	wanyusheng@bjshrimp.cn
21	YAN Zhen	Volcanic-sedimentation and tectonic setting of mineralization of the Caotangou Group in the western section of the North Qinling	2012-2015	yanzhen@mail.iggcas.ac.cn
22	ZHANG Jin	The provenance and deformation of Lower Paleozoic sediments along the southern and eastern margins of the Alxa Block and their tectonic implications	2012-2015	zhangjinem@sina.com
23	SHI Yuruo	SHRIMP U-Pb dating of diagenetic xenotime in sedimentary rocks - case study of the Changzhougou Formation	2012-2015	shiyuruo@bjshrimp.cn
24	LI Qiusheng	A broadband seismic observation profile in northern North China：to find the traces of upper mantle structures of the paleo-Asian Ocean	2012-2015	liqiusheng@cags.ac.cn
25	CHEN Shouming	Research on silicified acritarchs from the Ediacaran Doushantuo Formation at Shimen, Hunan, South China	2013-2015	shoumingchen@gmail.com
26	DONG Xin	Early Mesozoic metamorphism and tectonic significance of the central and eastern Lhasa terrane	2013-2015	dongxin5811935@163.com

27	XU Xiangzhen	Detailed FIB and TEM studies of unusual mineral inclusions in chromite and mantle peridotite from Kangjinla of Tibet	2013-2015	xuxiangzhensjl@aliyun.com
28	YU Shengyao	Relationship between high-pressure granulite and adakitic rocks - a case study in the Dulan area, North Qaidam Mountains	2013-2015	yushengyao1211@tom.com
29	MENG En	Petrogenesis of the Changhai khondalite series in southeastern Liaoning Province, China and its tectonic implications	2013-2015	mengen0416@126.com
30	LIU Dongliang	Cenozoic paleomagnetic research on the spatio-temporal variations of block rotation between the northeast margin of the Pamirs and southern margin of southwest Tianshan	2013-2015	pillar131@163.com
31	CAO Hui	New technique for the study of orogenesis and porphyroblast formation mechanism - Application of electron backscatter diffraction on foliation inflection/intersection axes (FIA)	2013-2015	caohuicags@gmail.com
32	PAN Jiawei	Partitioning of strike-slip and uplift during Late Quaternary deformation along the Ashikule fault, western segment of the Altyn Tagh fault	2013-2015	43469518@qq.com
33	ZHAO Lei	Ages, characteristics and tectonic implications of ophiolite from the southern Xiemisitai Mountain in West Junggar, Xinjiang	2013-2015	jleiz@163.com
34	DONG Aiguo	Magnesium isotope character and its constraints on the genesis of magnesite deposits in eastern Liaoning Province, China	2013-2015	aiguo.dong@gmail.com
35	LI Shizhen	Isotopic fractionation of Zn and Cu in plants	2013-2015	shizhenli@cags.ac.cn
36	WANG Yue	Iron isotope fractionation during fluid exsolution of skarn-type deposits: case study of a polymetallic deposit in the Middle-Lower Yangtze Valley	2013-2015	wyivy@aliyun.com
37	SONG Huixia	Petrogenesis of two periods of TTG gneiss in the Zanhuang area, Hebei Province	2013-2015	huixiasong@cags.ac.cn
38	YIN Jiyuan	Geochronological and geochemical study of basic-intermediate dikes in West Junggar, NW China	2013-2015	yinjiyuan1983@163.com
39	XIE Hangqiang	Zirconology of metamorphic oceanic crust, a case study from the Heilongjiang Complex in the Mudanjiang area	2013-2015	rock@bjshrimp.cn
40	QU Chen	Detailed receiver function images of fine crustal structures in the Tarim basin	2013-2015	quchen760511@163.com
41	KUANG Hongwei	Taphonomy of a Cretaceous dinosaur in the Jiaolai basin and implications for paleo-ecology and -geography	2013-2015	kuanghw@126.com
42	LV Junchang	The study of Cretaceous dinosaurian faunas from Henan Province	2013-2016	lujc2008@126.com
43	JIN Xiaochi	Establishment and correlation of Permian biostratigraphic sequences of the Tengchong Block, western Yunnan	2013-2016	jinxchi@cags.ac.cn
44	MENG Fancong	Genetic mineralogy of eclogite from the East Kunlun Mountains, western China	2013-2016	mengfancong@yeah.net
45	ZHANG Jianxin	Early Precambrian crustal evolution of the western Alxa block and constraints on the North China Craton	2013-2016	zjx66@yeah.net

46	QI Xuexiang	Identification of a Neoproterozoic magmatic belt in the Ailaoshan orogen and its tectonic implications	2013-2016	qxuex2005@163.com
47	WANG Tao	Characteristics of rock assemblages and formation ages of flysch mélange in the Bailongjiang Group in Western Qinling	2013-2016	real-wt@sohu.com
48	MA Xiaoli	Towards final agreement on the total slip-rate and location of the entire Karakorum fault, western Tibet	2013-2016	mlchevalier@hotmail.com
49	Chevalier Marie-Luce	Towards final agreement on the total slip-rate and location of the entire Karakorum fault, western Tibet	2013-2016	mlchevalier@hotmail.com
50	LI Jinyi	Provenance of Silurian-Permian clastic rocks on the northwestern margin of the Tarim basin and constraints on the closure time of the Paleozoic ocean in the Tianshan Mountains	2013-2016	jyli2003@126.com
51	ZENG Lingsen	Construction of large leucogranite plutons along the Himalayan orogenic belt and thermal effects	2013-2016	zls1970@gmail.com
52	SONG Yucai	Study of the large Chaqupacha Pb-Zn deposit in the Fenghuo Shan-Nangqian fold-thrust belt, Tibet	2013-2016	songyucai@gmail.com
53	YANG Zhiming	Sources of metal and sulfur in post-collisional porphyry Cu deposits: A case study of the Qulong copper deposit, Tibet	2013-2016	zm.yang@hotmail.com
54	ZHU Xiangkun	Genesis of the Shilu iron ore deposits, Hainan	2013-2016	xiangkun@cags.ac.cn
55	HE Rizheng	Structures of the frontier of the Asian mantle subducted southwards beneath North Tibet and effects on continental collision	2013-2016	herizheng@cags.ac.cn
56	LU Zhanwu	Research on the structural attributes of strong seismic reflections in the crust of the southern Qiangtang terrane in central Tibet	2013-2016	luzhanwu78@163.com
57	WANG Haiyan	Fine lithospheric structure and deep processes of the inland deformation in the Xuefeng Mountain tectonic zone	2013-2016	hyanwhy@126.com
58	DONG Jin	Paleosecular variations and environmental magnetism study on Holocene lake sediments from the monsoon marginal zone in eastern China	2014-2017	djin@cugb.edu.cn
59	GUO Lei	Spatial distribution, transition mechanism and timing of late Mesozoic crustal contraction and extension along the southeastern China-Mongolia border	2014-2017	guolei_cn@sina.com
60	GUO Xianpu	Study of Middle-Late Ordovician vertebrate fauna in Bachu County, southern Xinjiang	2014-2017	guoxianpu@cags.ac.cn
61	JI Shu’an	Early Cretaceous vertebrate fauna from the Ordos Basin (Inner Mongolia) and related stratigraphic correlation	2014-2017	jishu_an@sina.com
62	LI Yibing	Petrological and geochronological studies on varied magmatic evolution during the early stages of the Izu-Bonin-Mariana island arc	2014-2017	tansei007@aliyun.com
63	LI Zhaoli	Determination of the Songduo suture zone in the Lahsa terrane and Indosinian Orogeny of the Qinghai-Tibet Plateau	2014-2017	lizhaoli3@tom.com
64	LIU Chaohui	Tectonic features of the Zhaertai and Bayan Obo Groups on the northern margin of the North China Craton and their relationship with break-up of the Columbia supercontinent	2014-2017	denverliu82@gmail.com

65	LIU Fulai	Multiple metamorphic and partial melting events in the San Jiang complex, southeastern Tibetan Plateau	2014-2017	lfl0225@sina.com
66	LIU Yongqing	The Tuchengzi-Zhangjiakou Formations and basin evolution at the transition of the Jurassic-Cretaceous in the Yanshan Mts. and implications for the North China rift system	2014-2017	liuyongqing@cags.ac.cn
67	TONG Ying	Petrogenesis of Permian A-type granites in the middle segment of the border between Mongolia and China and tectonic implications	2014-2017	yingtong@cags.ac.cn
68	WANG Yanbin	Crust formation and evolution of the Archean Block of the Rauer Group, Antarctica: constraints from geochemistry and zircon U-Pb and Hf-O isotopes	2014-2017	fengguangying198@163.com
69	XU Jiren	Analyses of seismic data recorded at different depth of the Donghai 5000m borehole and study on the non-linear property of seismic waves in different layers and seismo-tectonics in and around the Tanlu Fault	2014-2017	xujiren1125@aliyun.com
70	YAN Zhen	Sedimentary analysis of the wedge-top basin within the ophiolite mélange belt in the Lajishan Mountains	2014-2017	yanzhen@mail.igcas.ac.cn
71	YANG Tiannan	Does the Longmu Co-Shuanghu suture connect with the Changning-Menglian suture?	2014-2017	yangtn@cags.ac.cn
72	YIN Chongyu	Study on the lower age of the Chang'an glaciation and biostratigraphy of the Cryogenian Period in South China	2014-2017	chongyuyin@cags.net.cn
73	YU Changqing	Deep structure and physical properties of the eastern Tarim basin	2014-2017	geoyucq@hotmail.com
74	ZHENG Hongwei	The crust and upper mantle 3-D seismic velocity structure and dynamics beneath the Tongbai Orogen and adjacent areas	2014-2017	zhenghongwei004@sina.com
75	ZHOU Xiwen	Metamorphic evolution and genesis of the Paleoproterozoic khondalite series in the Liaoning and Jilin regions	2014-2017	xwzhou@cags.ac.cn
76	CAI Zhihui	Study on the relationship between horizontal and vertical shear zones and kinematic implication of Diancangshan, southeastern Tibet	2014-2016	cai-zhihui@hotmail.com
77	FENG Guangying	Geochronology and geochemistry of Permo-Triassic mafic dykes in the Songnen-Zhangguangcailing Range, Jilin Province	2014-2016	fengguangying198@163.com
78	GUO Xiaoyu	Lithospheric structure of the Liupan Shan thrust-nappe belt, northeastern Tibetan Plateau and deep crustal deformation	2014-2016	guomichele@gmail.com
79	HAN Liang	The fine structure during fault healing and its impaction on the mechanical properties of the fault	2014-2016	hanliangla@163.com
80	LEI Min	Magmatic evolution and eruption dynamic processes for the cone-forming stage of the ChangbaishanTianchi volcano: evidence from melt inclusions	2014-2016	leiminlm@126.com
81	LI Jing	Mo isotopes of Mesoproterozoic Fe and Mn sedimentary formations of North China and implications for the paleo-oceanic environment	2014-2016	lijin80119@hotmail.com
82	LI Zhonghai	Subduction-induced mantle flow and seismic anisotropy: numerical modeling	2014-2016	lzhhai@gmail.com

83	LIU Pinghua	Petrology and metamorphic evolution of the Daqingshan-Wulashan high pressure granulite, northwestern North China Craton	2014-2016	lph1213@126.com
84	LIU Shoujie	Zircon characteristics under ultrahigh-temperature conditions: a case study of ultrahigh-temperature metamorphic rocks from Inner Mongolia	2014-2016	sjliu@bjshrimp.cn
85	LIU Yong	Geochemistry of Mesozoic basic rocks and interface conversion of asthenosphere in the Hunan-Jiangxi Province	2014-2016	liuyongfirst@163.com
86	NIU Xiaolu	Petrology and Os-Pb-Nd-Sr isotope geochemistry of Datong Triassic lamprophyres and geological significance	2014-2016	niuxiaoludx@126.com
87	WANG Fang	Genesis and metamorphic evolution of blueschists in the southern segment of the Lancang River, southwestern China	2014-2016	wangfang_mr@163.com
88	XIANG Hua	Genesis of early Paleozoic sapphirine-bearing mafic granulite in the Tongbai orogen	2014-2016	xianghua2710@gmail.com
89	YAN Bin	Fe and Mo isotopic constraints on Neoproterozoic negative carbon isotope excursions	2014-2016	yanbin703@163.com

2.2 Projects funded by the Ministry of Science and Technology and/or the Ministry of Finance

No.	Chief Investigator	Project	Duration	E-mail address
1	ZHU Xiangkun	Mechanisms of Neoproterozoic mineralization of Mn, Fe and P in the Yangtze basin	2014-2016	xiangkun@cags.ac.cn
2	PI Jinyun	Long-term deep borehole geophysical observations and comprehensive data analysis	2014-2016	jinyunpi@163.com
3	WANG Tao	Superposition of the Mongol–Okhotsk plate tectonic regime on the Paleo-Asian ocean plate and its metallogenic systems	2013-2017	taowang@cags.ac.cn
4	SHI Yuruo	In-situ SHRIMP U-Pb dating of U-bearing accessory minerals (rutile and baddeleyite)	2013-2015	shiyuruo@bjshrimp.cn
5	WANG Yue	Fe isotopic study on the metallogenesis of terrestrial facies volcanic deposits	2013-2015	wyivy@aliyun.com
6	XU Zhiqin	Orogenic types and orogenic mechanism of China	2012-2014	xzq@ccsd.cn
7	LIU Dunyi	Research and development of new TOF-SIMS instruments for isotope geology	2011-2016	liudunyi@bjshrimp.cn
8	HOU Zengqian	Continental convergence and metallogenesis south of the Tibet Plateau	2011-2015	houzengqian@126.com
9	PAN Xiaofei	Mineral regulations and prospecting model of the Jian-Dexing Cu-Mo polymetal belt	2011-2014	pan_smile0551@sina.com
10	YAN Zhen	Model for deep prospecting, exploration technology integration, and genesis of porphyry CuMoAu deposits in the Shanyang-Zhashui ore concentration area, Shanxi Province	2011-2014	yanzhen@mail.iggcas.ac.cn
11	DING Xiaozhong	Geological records and maps of China and tectonic maps of Eurasia	2011-2016	xiaozhongding@sina.com

12	YANG Jingsui	Pilot research on scientific drilling site-selection of the Luobusa chromite, Tibet	2013-2014	yangjsui@cags.ac.cn
13	XU Zhiqin	China continental scientific drilling site-selection and drilling experimental integration research	2013-2014	xzq@ccsd.cn
14	WU Cailai, XUE Huimin	Pilot research on scientific drilling site-selection in the eastern mineralization congregate area, China	2013-2014	wucailai@hotmail.com huaiminx@sina.com.cn
15	ZHANG Zeming	Pre-research on scientific drilling site-selection in the Laiyang basin, Shandong – northern boundary of the Yangtze plate	2013-2014	zzm2111@sina.com
16	GAO Rui	Probing experiment by deep seismic reflection profiling and research into the structure of the crust	2013-2014	ruigao126@126.com
17	LU Zhanwu	Deep probing technology integration and tests of integrated technology of geophysical cross-section structure	2013-2014	luzhanwu78@163.com
18	LI Qiusheng	Broad band seismic observations and crust-mantle velocity research	2013-2014	liqiusheng@cags.ac.cn
19	HE Rizheng	Multi-scale imaging techniques and central-east crust-mantle velocity and density imaging research	2013-2014	herizheng@cags.ac.cn

2.3 Projects funded by the China Geological Survey

No.	Chief Investigator	Project	Duration	E-mail address
1	YU Changqing, YANG Wencai	Investigation of geophysical sections in the Tarim basin	2014	geoyucq@qq.com
2	LIU Fulai, LIU Chaohui	Important geological events, curstal growth and tectonic evolution of the Early Precambrian North China Craton	2014-2016	lfl0225@sina.com
3	WAN Yusheng	Formation and evolution of ancient terranes (>2.6 Ga) of the North China Craton	2014-2016	wanyusheng@bjshrimp.cn
4	LIU Pinghua, ZHAO Ziran	Genetic mechanism of the Helan-shan-Wulashan-Huangtuyao Paleoproterozoic orogenic belt on the northern margin of the North China Craton	2014-2016	lph1213@126.com
5	YANG Chonghui, DU Lilin	The Paleoproterozoic rock-stratigraphic framework, geological events, and setting of mineralization in the central North China Craton	2014-2016	chhyang@cags.ac.cn
6	MENG En, YANG Hong	Tectonic nature and evolution of the Jiao-Liao-Ji Paleoproterozoic mobile belt in the eastern North China Craton	2014-2016	mengen0416@126.com
7	YAO Jianxin	Protection and research of representative standard sections in China	2014-2016	yaojianxin53@163.com
8	JI Shu'an, JI Qiang, LV Junchang	Dinosaur fanuas, biostratigraphy and classic fossiliferous sections of China	2014-2016	jishu_an@sina.com
9	LIU Pengju	Biostratigraphic succession and chrono-stratigraphic subdivision of the Ediacaran in China	2014-2016	pengju@cags.ac.cn
10	LIU Yan, LI Tianfu	Tectonic framework, evolution process and mineralization of palaeo-Tethys in middle Qinghai-Tibet Plateau.	2014	yanliu0315@126.com

11	CHEN Songyong, LI Yibing	Research on geological background of ophiolite and chromite mineralization in the Bangong-Nujiang suture	2014	chensongyong@163.com
12	LI Zhaoli, ZHANG Cong	Petrogenesis of Songduo Paleo-Tethys suture zone and its tectonic background	2014	lizhaoli3@tom.com
13	SU Dechen	Depositional system and evolutionary history of the Tethyan oceanic basin at the eastern rim of the Qinghai-Tibet Plateau	2014	sudechen@hotmail.com
14	QI Xuexiang, QIN Haipeng	Paleotethyan magmatism and mineralization in southeastern Tibet	2014	qxuex2005@163.com
15	YANG Jingsui, XU Xiangzhen	Tectonic evolution of the Paleo- and Neo-Tethys oceanic basin and chromite metallogenesis in Tibet	2014	yangjsui@163.com; yangjsui@cags.ac.cn
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36	LIU Chaohui	Formation age and tectonic characteristics of Cha'ertai Group and Baiyun'ebo Group in north edge of North China.	2014	denverliu82@gmail.com
37	WANG Yanbin	Early Palaeozoic magmatic events in the Himalayas of south Tibet: source, tectonic setting and age of emplacement	2014	wangyanbin@bjshrimp.cn
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40	ZHANG Jin, QU Junfeng	Research on the tectonic setting and stages of deformation events along the Qinhang Suture Zone in the Neoproterozoic to Late Triassic	2014-2016	zhangjinem@sina.com
41	WANG Tao	Investigation of metamorphic rocks and copper-gold deposits in West Zhejiang Province and Northeast Jiangxi Province, South China	2014-2016	real-wt@sohu.com
42	GAO Rui, HOU Hesheng, LI Qiusheng	Upper Paleozoic geophysical discrimination technology research test inSongliao Basin and its peripheral areas	2014-2015	ruigao126@126.com
43	XUE Huaimin	Time-space evolution, tectonic background and mineralization significance of volcanic rocks in the important mineralization belt	2014-2015	huaiminx@sina.com.cn
44	LI Haibing, SI Jialiang	The Longmenshan seismic fault zone and long-term observations in the Wenchuan earthquake scientific drilling borehole	2014	lihaibing06@163.com
45	PI Jinyun, YU Changqing	Gas hydrate exploration in the permafrost region south of Qinghai and northern Tibet	2011-2014	jinyunpi@163.com
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49	LIU Jianfeng	Synthetic geological survey and mapping of the tectonic division of the Great Xing'an Range	2013-2014	wenjv@aliyun.com
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54	REN Jishun	Geological and tectonic maps of China and adjacent areas at a small scale	2013-2014	renjishun@cags.ac.cn
55	REN Liudong	Studies on the Pan-African geology, Proterozoic stratigraphy and Tethys Devonian-Triassic paleogeography of China and adjacent areas	2013-2014	ldren@cags.ac.cn
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59	XIANG Zhongjin, YAN Quanren	Study of paleo-Tethyan orogenic processes and geological background of ore deposits in the southwestern segment of the Qingzhou-Hangzhou tectonic belt and adjacent regions, southwestern China	2013-2015	qryan@cags.ac.cn
60	ZHANG Jin	Geological survey and study on the metallogenic geological background and basic tectonic framework of the Tianshan-Xingmeng orogenic region	2013-2015	zhangjinem@sina.com
61	ZHU Xiangkun	Development and application of isotope tracers in Precambrian geology	2013-2015	xiangkun@cags.ac.cn
62	HOU Zengqian	Orogenic processes and geological background of the middle-eastern Tibetan collisional orogen	2013-2015	houzengqian@126.com
63	SONG Yucai, WANG Jun, LU Minjie	Geological setting, metallogenesis, and mineral prospecting of improtant ore deposits in the Andes orogen	2012-2015	songyucai@gmail.com
64	LI Haibing, LIU Dongliang	Deep geological survey of the Longmen Mountain tectonic zone	2012-2014	lihaibing06@163.com
65	QU Chen, YU Changqing	Application of integrated geophysical technology in deep geological surveys	2012-2014	quchen760511@163.com
66	WANG Haiyan	Deep crustal geological survey of the intersection zone between the Central Orogenic Belt and the North-South Tectonic Belt	2012-2014	ruigao126@126.com
67	ZHANG Hongrui	Tectonic setting, metallogenesis and prospecting potential of the main mineral deposits in the central Tethyan area	2012-2014	song_yucai@yahoo.com.cn
68	YU Changqing	Exploration of gas hydrates in the Qilian Mountains and adjacent areas	2012-2014	yucq@tom.com
69	YAO Jianxin	Perfection and correlation of the stratigraphic system of different regions	2011-2015	yaojianxin@gmail.com
70	GUAN Ye, GUO Lei, LU Minjie	Integration of 3-D geological mapping and construction of informaiton platform	2011-2014	guanye@cags.ac.cn
71	LI Tingdong	Comprehensive integration of the Divisions of Geological Structure and Regional Geological Survey of China	2008-2015	litdong@163.com

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3. Research achievements and important progress

3.1 Results of Natural Science Foundation projects completed in 2014

Himalayan Pb-Zn-Cu-Ag ore deposits along the eastern and northern margins of Tibet: Ore-forming system and mechanism (Chief Researcher: HOU Zengqian)

This study shows that the Lanping basin experienced at least three phases of compressional deformation: (1) Late Middle Triassic compression was in an E-W direction, and Middle and Lower Triassic strata formed a tight overturned fold with penetrative axial cleavage; (2) Late Jurassic compression was in an E-W direction, and the Jurassic and pre-Jurassic strata formed open and superimposed folds; (3) Paleogene compression was in a NE-SW direction, and Oligocene and pre-Oligocene strata display open and superimposed folds. During the Paleocene to the early Eocene, compression was slow, and the basin was filled with lacustrine fine clastic rocks with evaporatites; during the late Eocene to Oligocene, compression was strong, accompanied by strike-slip and thrust structures, and the basin was filled with alluvial fan facies clastic rocks. Geological mapping classified the lithologies in the Jinding super large lead-zinc deposit into an allochthonous sequence, salt diapir-related rocks, and an autochthonous sequence. They are spatially distributed into upper, middle and lower parts. Among these lithologies, the salt diapir-related rocks comprise diapiric sand, various types of breccias, and gypsum. They are genetically linked to diapir-brecciation of the host rocks, followed by flow into a fluival system, caused by regional NE-SW thrusting. The orebody mainly appears in the lithologies related to salt diapirism. The hydrocarbon-rich fluid in the dome reacted with the gypsum through BSR±TSR and then formed H_2S. Subsequently, mineralization occurred bys mixing of H_2S and basin fluids transporting lead and zinc. The entire sediment-hosted ore-forming system includes: structurally-controlled vein copper, sediment-hosted stratiform copper (SSC), MVT Pb-Zn, Pb-Zn-Cu-Ag polymetallic vein systems. The structurally-controlled vein copper deposits formed during 60-49 Ma and 19 Ma. The Pb-Zn (-Cu-Ag) systems mainly formed during 35-29 Ma and later than 23-20 Ma; early stage thrusting led to ore-controlling structures, and late stage slip/extension led to fluid discharge and ore accumulation. Ore formation of MVT Pb-Zn deposits was related to lateral fluid migration driven by gravity through thrusting, followed by vertical fluid discharge through regional slip/extension. The Pb-Zn-transporting fluids were derived from down-infiltration basinal brines, and the metals were likely extracted from volcanic rocks and/or overlying sedimentary strata. The ore-controlling structures include lithological transitions, salt dome structures, karst/hydrothermal caves, faults and fractures. The ore-hosting rocks are salt diapir-related and Carboniferous-Triassic carbonate rocks. Reduction through fluid mixing or water-rock interaction led to metal precipitation.

Unusual minerals in ophiolitic mantle rocks and chromite and deep geological processes (Chief Researcher: YANG Jingsui)

Ophiolitic mantle rocks and chromitites are generally thought to have formed near the top of the upper mantle. However, our discovery of diamonds and highly reduced minerals in ophiolitic chromitites significantly challenges this model. Progress and main results of our ongoing study are as follows: 1. A very significant milestone is that diamonds have now been shown to occur in-situ within chromite grains from the Luobusa and Polar Ural chromitites. This discovery has ended all doubts about the diamonds being the result of contamination during sample processing.

Previously such contamination could not be conclusively ruled out because all diamonds had been obtained from mineral separates. 2. The C isotope compositions and mineral inclusions of diamonds from Luobusa and the Polar Urals are very similar but very different from most kimberlitic diamonds and UHP metamorphic diamonds. Thus, we propose a new model for the occurrence of diamonds, termed ophiolite-hosted diamond. Ophiolite-hosted diamonds are characterized by light C isotopes ($\delta^{13}C$ -18 to -28) and typical Mn-bearing mineral inclusions such as Mn-olivine, Mn-garnet, Mn-spinel and Co-Mn-Ni alloys. These features, along with their typical occurrence in oceanic mantle rocks, clearly distinguishes them from kimberlite diamonds within cratons and UHP metamorphic diamonds at plate margins. 3. We have greatly increased the number of ophiolites known to contain diamonds. Diamonds and highly reduced minerals have now been confirmed in mantle peridotites or chromitites from 11 ophiolites in 5 orogenic belts in different parts of the world. These include the Luobusa, Zedang, Xigaze, Dangqiong, Parang and Dongbo massifs in the YarlungZangbo suture and the Dingqing massif in the Bangong-Nujiang suture of Tibet, the Myitkyina massif in Myanmar, the chromitites in the Sartohaiand-Hegenshan massifs of the Central Asian Orogenic Belt in Inner Mongolia, and the Ray-Iz massif in the Polar Urals. Thus, we propose that diamonds and their associated unusual minerals may be common within the oceanic mantle, although not present in great abundance. If this can be proven by future studies, it will provide a previously unrecognized feature of the mantle and will lead to a better understanding of ophiolite and chromitite formation. 4. We discovered a new UHP mineral, named Qingsongite, which was approved by the International Mineralogical Association (IMA2013-30). Experimental studies indicate that Qingsongite, which occurs as inclusions in coesite in the Luobusa chromitite, formed at 10-15 GPa and ca. 1300 °C. The discovery of Qingsongite and stishovite pseudomorphs in the Luobusa chromitite has led us to propose a model for the deep formation of ophiolite-hosted diamonds and chromitite. In this model, UHP minerals and chromite grains crystallized simultaneously at a depth near the mantle transition zone and were later brought to shallow levels by upwelling mantle and emplaced in ophiolites.

Response of late Mesozoic biota evolution and environment to craton break-up of North China (Chief Researcher: LIU Yongqing)

This project concentrated on the relationship between the destruction of the North China Craton, environmental upheaval and the evolution and succession of biota. It analyzed the modal of geological event-environmental change-biological evolution, based on the distribution of Late Mesozoic volcano-sedimentary basins, filling sequences, paleoenvironment and paleogeography; paleo-fauna, paleoenvironment and paleoecology, and geochemistry, and proposes some important provenance for a connection between the destruction of the North China Craton and environmental transition, biota co-evolution and geological event-environmental change. A nearly complete Mesozoic terrestrial stratigraphic record and volcano-sedimentary sequence are presented for northern China (North China-Northeast China), providing rich sources of information for basin development, terrestrial sedimentary-ecological paleogeography and tectonic setting. Mesozoic basins in North China have experienced five periods of deposition: (1) Early-Middle Triassic; (2) Late Triassic-Early-Middle Jurassic; (3) Late Jurassic-early Early Cretaceous; (4) middle-late Early Cretaceous; (5) Late Cretaceous. The syn-orogenic to post-orogenic Triassic-Early-Middle Jurassic period in northern China experienced extensive extension, and later initiated the Yanshan movement (episode A) (165/160 Ma), characterized by intensive thrust-nappe and fold deformation an resulting from the closure and orogeny of the Mongol-Okhotsk Ocean and oblique subduction of the paleo-Pacific plate along the continental margin of East Asia. Late Jurassic-early Early Cretaceous regional extension and a rift system developed in the North China Craton and in northeastern China. We interpret the Yanshan-Great Xing'an Range of this period as the northeast Asia rift system, which is filled with giant, thick intermediate to basic volcanic rocks, fluvial-lacustrine sedimentary rocks and felsic volcanic-volcaniclastic rocks in the upper part (165-130 Ma), marking the initiation of destruction of the North China Craton. The dynamic mechanism is post-orogenic collapse of the Mongol-Okhotsk Orogenic Belt and strike-slip activity caused by the

paleo-Pacific plate along the margin of eastern Asia. During the middle-late Early Cretaceous, the North China Craton and northeastern China experienced considerable regional extension, and rift basins formed at different scales and reached a climax. These rift basins were filled with thick sequences of intermediate-basic volcanic rocks and fluvial-lacustrine sediments, representing the peak of lithospheric thinning and destruction of the North China Craton. An angular unconformity at the base of these strata reflects the Yanshan movement (episode B) (130 Ma), which can be correlated with deformation in eastern and northeastern Asia. The rift system and associated volcanic-fluvial-lacustrine sedimentation gradually migrated eastwards, suggesting that the tectonic dynamic mechanism was controlled by back-arc extension induced by oblique subduction of the paleo-Pacific plate beneath the eastern Asian continent. Up to the late Mesozoic, northeastern and eastern China had identical tectonic, geographic and ecological environments. The land fauna and flora were similar in these two areas, characterized by feathered dinosaurs, primitive birds, pterosaurs, mammals, insects and the early angiosperms. In the mid-late Jurassic, the Yanliao Biota and mid-late Early Cretaceous Jehol Biota were typical representatives, without the occurrence of biota alternations.

The nature of Cenozoic crustal anatexis in the Namche-Barwa Massif, Tibet, and tectonophysical implications (Chief Researcher: Zeng Lingsen)

W carried out a systematic investigation on the petrography, mineralogy, geochemistry, and geochronology of high-grade metamorphic, migmatitic and leucogranitic rocks of the Namche-Barwa massif and adjacent areas of the Himalayan orogenic belt, southern Tibet. We acquired important data to constrain the geochemical nature and timing of crustal anatectic events in this study area. Major progress is listed as follows: (1) The Himalayan orogenic belt experienced at least two episodes of crustal anatexis during Eocene (~43-44 Ma) and early Oligocene times. These events represent partial melting of amphibolite under crustal compression and thickening conditions. (2) The Himalayan orogenic belt within China also experienced metamorphism up to granulite-facies during the Eocene (45-47 Ma). Garnet amphibolite and augen gneiss within the Tethyan Himalayan belt experienced high grade metamorphism at 45.0±1.0 Ma and 47.61.8 Ma, respectively, which may be correlated to coesite-bearing eclogites in the western Himalaya. (3) In young and hot, rapidly exhumed high-grade metamorphic massifs such as the Namche-Barwa, amphibolite may also have undergone partial melting due to influx of water and other volatile components and produced granitic melts characterized by high Na/K and Sr/Y ratios; (4) The Namche-Barwa massif also experienced a major episode of anatexis during early Miocene times. Granulite-facies metapelites, except for younger than 10 Ma events, also experienced at least two episodes of high-pressure water-fluxed melting at ~25 Ma and ~21 Ma, respectively, which produced high CaO and Na/K granitic melts and shows substantial Nd isotopic disequilibrium due to the presence of ancient garnet. Documentation of high CaO and Na/K granitic melts produced by water-fluxed melting of metasediments under high-pressure conditions could be important to improve our understanding of the petrogenesis of leucogranites in the Himalayan orogenic belt in particular and other orogenic belts worldwide in general. (5) Together with results from other localities, our studies demonstrated that partial melting reactions are strongly coupled with a tectonic transition (e.g. compression to extension) experienced by the high-grade metamorphic rocks and, in turn, anatectic granite may provide a critical example to investigate the physical and chemical behavior of middle to lower crustal rocks in evolving large orogenic systems.

Geochemical record on boron-enriched rocks from the Larsemann Hills, East Antarctica (Chief Researcher: WANG Yanbin)

Unusually borosilicate-bearing sedimentary rocks are exposed in the Larsemann Hills, Antarctica. The borosilicates consist of prismatine, grandidierite and tourmaline. Identifying the original paleogeographic setting is difficult in high-grade metamorphic terranes where the effects of metamorphism has obscured most primary depositional features. New ion microprobe U-Pb zircon ages show that the boron-bearing paragneisses have an estimated maximum depositional age of 1000-1100 Ma, and the oldest inheritance is 3091 Ma. Metamorphic rims on detrital zircons define a broad discordia array between ca. 850 Ma and ca. 519-550 Ma, which is interpreted to reflect metamorphic zircon growth or resetting at these times. Through detailed textural observations, average P–T calculations for the boron-bearing pelitic granulite indicate that peak M1 conditions reached ~9.0 kbar and ~900 °C, and the overprinting M2 assemblage formed under P–T conditions of ~7.0 kbar and 800–850 °C, reflecting post-peak near-isothermal decompression. P–T estimates show that M3 conditions reached at 4–5 kbar and 700–750 °C. These data imply that the M1 metamorphic evolution of the region displays contrasting P–T paths, whereas the M2 to M3 evolution indicates a decompression-cooling process. The available chronological data suggest that the M1 metamorphic evolution occurred during the late Proterozoic (1000–900 Ma) Grenvillian high-grade compression tectonic event (D1) and was accompanied by strong magmatism. However, the overprinted M2 to M3 metamorphic evolution formed during early Palaeozoic (~530 Ma) high-grade tectonic events (D2–D3), and was associated with important intracontinental reworking. Boron isotopic composition as a provenance indicator of borosilicate minerals and isotopic compositions of crustal protoliths may retain distinctive compositions inherited from their depositional or metamorphic histories. The B isotopic composition will be used to investigate the initial cause of boron enrichment as well as processes that redistributed boron during metamorphism. We report boron isotope data for borosilicates from the Larsemann Hills, East Antarctica. The lightest $\delta^{11}B$ values (-10.6 to –34.6 ‰) were found in borosilicates and are most compatible with boron derivation from non-marine evaporite borates. Thus, we suggest that the isotopically light boron at Larsemann Hills may have been derived from non-marine evaporites, as this is the only known reservoir containing sufficiently light boron to explain the borosilicate $\delta^{11}B$ values.

Basic dikes and the Gondwanian northern margin break-up event in the Qiangtang area, Qinghai-Tibet plateau (Chief Researcher: ZHAI Qingguo)

This study focused on Early Permian mafic dyke swarms in the Qiangtang area, northern Tibetan Plateau. Petrological, geochemical isotopic and geochronological investigations were carried on these mafic rocks, and the evolutionary history of the Paleo-Tethys Ocean as well as the tectonic evolution of the northern margin of Gondwana are discussed. A large number of mafic dykes are present in the South Qiangtang area, northern Tibet. Zircon SHRIMP U-Pb analyses indicate that they were emplaced during the Early Permian (~283 Ma). The chemical and isotopic characteristics show that the mafic dykes are similar to the Panjal Traps and Permian basalts in the Tethyan Himalayas, showing characteristics of continental intra-plate basalts. These basaltic rocks are suggestive of an Early Permian mantle plume, which may be linked to the break-up of the northern margin of Gondwana and opening of the Meso-Tethys Ocean during the Permian. Early Paleozoic (501-437 Ma) and Early Carboniferous (357-345 Ma) ophiolitic mélanges were identified in the Qiangtang area, northern Tibetan plateau. Detailed petrological, geochemical and geochronological investigations suggest that the opening of the Paleo-Tethys Ocean in this area was as early as Cambrian. The ophiolitic mélange of the Qiangtang area is comparable to those from the Sanjiang and Kunlun areas.

Relationship between high-pressure granulite and ultrahigh pressure eclogite in collisional orogens and geodynamic implications (Chief Researcher: ZHANG Jianxin)

This project focused on studies of high-pressure (HP) granulites and associated ultrahigh pressure eclogite from the Early Paleozoic South Altun-North Qaidam collisional orogen in northern Tibet. The following important results have been obtained: 1) Based on field geology, petrology and geochronology, we confirmed the origin and age of the eclogite protolith and associated rocks in the north Qaidam UHP metamorphic belt and reconstructed the evolutionary history of UHP metamorphism. 2) Based on the studied high-pressure granulites in the north Qaidam-south Altun orogen, we subdivided these rocks into two types: type I HP granulite experienced a single metamorphic history, whereas type II HP granulite resulted from overprinting of eclogite during exhumation. 3) Based on zircon-rutile thermometry and U-Pb chronology, peak metamorphic conditions and ages of the protolith and metamorphism of the south Altun HP granulites are well constrained, indicating that the HP granulites experienced peak ultrahigh temperature and high pressure metamorphism at ca. 495 Ma, followed by a medium-pressure/medium temperature granulite-facies overprint before ca. 450 Ma. 4) A small HP granulite unit is recognized in the Dulan area, eastern north Qaidam Mountains. The peak metamorphic conditions of HP granulites are at 850-950 ºC and 1.45-1.85 GPa, followed by isothermal decompression. HP granulites preserve features diagnostic of anatexis with the formation of adakitic leucosome. Geological, petrological, geochronological and geochemical evidences suggest that HP granulites formed in the overriding upper plate at relatively high geothermal gradients (15-18 ºC/km), whereas the UHP eclogite in the subducted plate formed during a relatively lower geothermal gradient (6-10 ºC/km) in the Dulan area, suggesting a possible paired metamorphic belt that was generated in a subduction-collision setting associated with the North Qaidam collisional orogeny during the Late Ordovician-Early Silurian.

Tectonic setting and orefield structures of the Bayan Obo ore deposit (Chief Researcher: ZHANG Yuxu)

For a long time, there have been different opinions on the genesis and formation time of the Bayan Obo deposit, therefore the foundation for studying the tectonic setting and orefield structures of the Bayan Obo deposit is weak. After a study of more than ten years, and having combined our data with those of other researchers, we found evidence for the origin of the deposits. We believe that the ore-bearing dolostones are hot-water sediments, and the formation time was early Paleozoic. We also think that both the Bayan Obo ore deposits and the hosting Bayan Obo Group were formed in a passive continental margin basin in early Paleozoic times. Our major achievements are listed below: (1) We found seismic liquefaction dykes at several outcrops in the Bayan Obo Group, the same as those found in the Sailinhudong Group. We also found several olistostrome or slump deposits in carbonate rock outcrops in the Bayan Obo Group. Similar basal conglomerates were found both in the Bayan Obo and Sailinhudong Groups. Detrital zircon age dating and zircon compositions show that the two groups share common characteristics such as the same provenance and age distribution types. Thus, we believe that the Bayan Obo and Sailinhudong Groups belong to the same time period, namely the early Paleozoic. (2) The ophiolite belt found in the north of Bayan Obo, at Chaganchulu, is a ductile zone and a thrust belt composed of ophiolite, carbonate rocks, quartzite and slate, distributed along an W—E trending valley. (3) Many W—E trending thrust belts occur parallel to each other to the north of Kuangou, causing tectonic repeat of stratigraphic sequences. This was induced by compressive stress in a N—S direction along the northern margin of North China Block, and thus the Bayan Obo Group should not have been so "thick" as described before. According to the facts mentioned above, we believe that both the Bayan Obo Group and the ore deposits were formed in the early Paleozoic. The Group formed in a passive continental margin basin on the North China Block.

Metamorphic geology of the Mashan Complex and its comparison with the Prydz Belt of Antarctica (Chief Researcher: REN Liudong)

Metamorphism, migmatization and geochronological studies of the high-grade Larsemann Hill area, East Antarctica, and that of the Mashan massif, NE China, show that two distinct types of metamorphism can be observed in the medium-high grade regions, i.e., granulite-facies metamorphism and related fluid-absent partial melting, and subsequent widespread magmatism responsible for migmatization and amphibolite-facies retrograde metamorphism, and typical textures were determined. The post-peak migmatization generally caused severe disturbance or resetting of the earlier U-Pb isotopic system in zircon, causing some uncertainty in the dating of metamorphism. A geological correlation of the Larsemann Hills and Mashan Complex has demonstrated that the Prydz Bay belt is dominated by a earlier granulite-facies metamorphism, whereas late granites and migmatites prevail the Mashan Complex. The Prydz Bay belt was situated in the centre of the reconstructed Gondwana Supercontinent. The Mashan Complex developed under similar tectonic conditions to that of Gondwana peripheral orogens. We summarize that in the late Neoproterozoic-early Paleozoic period, mobile belts similar to those of the peri-Gondwana formed around the Siberian craton, but the mobile center diverged within the two continents, and the Siberia margin, such as the Mashan Complex, were not part of Gondwana.

Carboniferous-Permian reefs and building conditions in Eastern Inner-Mongolia (Chief Researcher: TIAN Shugang)

This project discovered Permo-Carboniferous reefs in the Xing-Meng area which filled an hole in reef-studies of northern China. Based on more-strict fossil zonation, and detailed research on organism evolution and stratigraphic sequences, biostratigraphic scheme of divisions and correlations has been reviewed and improved. A tectono-stratigraphic framework has been erected and a district division of the Permo-Carboniferous has been reviewed by studying the tectono-stratigraphy, tectonic patterns and sedimentary facies. Some basic reef-features, e.g. reef-building types, column ecologies and facies sequences, etc. were distinguished by studying reefs of the Zhalaite Banner and the Xiwuzhumuqin Banner. The space distribution of 3 reef-chains has been investigated, and their relationship has been discussed between the chain distribution with plate movement and biogeography. Tectono-sedimentary conditions have been restored for the studied reefs, and 3 tectono-geography charts have been drawn, based on the above achievements. Environmental variations of the study areas have been verified in that the Solen—Xilamulun Fault represents the northern margin of the North China Block, and the Chagan Aobao—Arong Flage Fault marks the southern margin of the Siberian Block. The environment during the Late Carboniferous—Early Permian was a poly-island ocean (the paleo-Asia ocean), which narrowed in the Middle Permian to the Xing-Mongolia marine trough, and in the Late Permian changed into the Xing-Mongolia shallow marine trough.

Restudy on the problematic fossil Tianzhushania in the early Ediacaran (Sinian) period (Chief Researcher: YIN Chongyu)

Based on a detailed identification and collection of fossiliferous chert layers, especially sectioned studies of the enrichments of Tianzhushania, the following main conclusions were obtained. (1) The inner wall of Tianzhushaniaornata consists of different types of sculptures, including polygon plates, polyones with fractal branching, tubercles, tubercles with dimples and cerebral ornaments, which are the same as in the original description of the phosphatized spheroidal fossils Megasphaeraornata (Xiao and Knoll, 2000). (2) According to a smooth inner wall, different tubercles, and the feature of polygon plates, *Tianzhushania* can be divided into three species, namely *T. spinosa* (type species) with a smooth inner wall, *T.tuberifera* with a different tubercles inner wall, and

the type with different polygon plates should be considered as a new species. (3) Its complex vesicle structures and a "budding behaviour" found in some specimens, as well as evidence for a nucleus and elongated nucleus in the process of division of subcellular bodies prove that these Tianzhushania fossils are neither animals nor embryos. They belong to encysting protists, representing an early evolutionary stage with the palintomic cleavage. (4) Based on chronostratigraphic studies, the Sinian System is proposed to consist of 2 series and 4 stages. In ascending order, the lower series includes the Jiulongwan and Chenjiayuanzi stages, and the upper series includes the Diaoyipo and Dengying stages. The boundary age between the lower and upper series is inferred at 580 Ma, the age between Diaoyapo and Dengying is 550 Ma, and the age between Jiulongwen and Chenjiayuanzi is about 610 Ma.

Characters of Fe isotopes and ore-forming mechanism for Xuanlong type iron ore deposits (Chief Researcher: LI Zhihong)

The Xuanlong-type iron formation is a large-scale epicontinental sedimentary iron ore deposit in China. It was deposited during the early Proterozoic Chuanlinggou Formation of the Changcheng System, which has caused great attention because of its kidney-type or oolithic texture. The results of Fe isotopes, major, trace, and rare earth elements and Nd isotopic compositions of the Xuanlong type iron ore deposit are reported as follows: (a) Relative to IRMM-014, hematites show heavy Fe isotope enrichment, whereas siderite and wall rocks show negative values. (b) The average bulk composition of iron ore are characterized by high total Fe_2O_3, and relative enrichment in Al_2O_3, TiO_2 and P_2O_5. The overall content in trace elements is similar to those of the average crust but with distinct enrichment in redox-sensitive trace elements (V, U, Mo). The total rare earth element contents are high, and the shale-normalized REE patterns display depletion in the light REE relative to heavy REE, no significant positive Eu anomalies and low Y/Ho values. The iron ore samples have negative values of initial Nd. These characteristics demonstrate that the iron source of the Xuanlong type iron ore deposit was dominated by detrital input. (c) Hematite shows heavy Fe isotope enrichment relative to IRMM-014, which provides evidence for the presence of Fe-oxidizing bacteria. (d) Geochemical features, including the lack of negative Ce anomalies, enrichment in V, U, Mo, and heavy Fe isotope enrichment of hematite samples implies that oxygen fugacity in the depositional environment was relatively low.

Rheological character of mantle rocks from the Luobusha ophiolite, Tibet: Implication for the genetic mechanism of chromitite formation (Chief Researcher: LIANG Fenghua)

The Luobusa ophiolite is located in the east part of the Yarlung-Zangbo suture zone, Tibet. It is one of the most typical sections and the largest chromite deposit in China. The origin and emplacement mechanism of the Luobusa ophiolite has become the center of debate since the discovery of diamond, coesite and many other unusual deep-mantle minerals in Luobusa mantle peridotites and chromites. Employing detailed tectonic studies, we found different contact relationships between the ophiolite and different country rocks. Between ophiolite and T3 and RL, two regional ductile shear zones, DFT and DFR, were confirmed as limiting boundaries of the ophiolite. DFT formed at the end of the Late Cretaceous or even earlier with high temperature shearing and metamorphism during the obduction stage of the ophiolite from north to south. This was later modified at the time of DFR formation. DFR formed at the beginning of the Miocene under low temperatures with regional overturned folds in the north of the Himalaya orogenic belt, caused by continuing collision between India and Asia. These structures formed at different time under different conditions and are not reverse thrusts of the MCT. By further studies on the rheology of Luobusa mantle peridotites, a new type of olivine fabric (100)[010] ((100) parallel to foliation, and [010] parallel to lineation) was recognized. Comparing the evolutionary stages of the Luobusa mantle peridotite, the new olivine fabric may represent some special mantle rheological setting that formed at a mid-ocean ridge with the participation of a mantle

plume. Recrystallization and the second stage of deformation may have developed during high temperature and fluid-rich conditions during the obduction process of the ophiolite, and the fabric of olivine was inherited and weakened.

Temporal constraints and mechanism of the late Mesozoic tectonic transition from contraction to extension in the Daqing Shan and adjacent areas (Chief Researcher: GUO Lei)

Our group has summarized the pattern and time of Late Mesozoic tectono-magmatic evolution of the Eastern Daqing Shan which is mainly occupied by the Hohhot metamorphic core complex (MCC), based on detailed structural analysis, geochronological data and geochemical data. The progress is as follows: 1) Based on deformation temperatures and degree of deformation in the shear zone, we determined that deep-level ductile shearing was initiated at 148 to 140 Ma and ended at about 132 Ma, which indicates uplift from high-medium temperature to low temperature conditions. 2) We recognized at least four phases of deformation in the study area, which indicates a late Mesozoic structural pattern (early southward contraction, peak SE-directed ductile extension, later NW thrusting, later collapse and doming). 3) Geochemical modeling (using the MELTS code) suggests that similar sources but different depths of magma generation produced the early, high-pressure low-Mg adakitic granitoids and late, low-pressure granitoids with A-type characteristics in the Hohhot MCC. This granitic magmatic evolution coincided with the tectonic transition from crustal contraction to extension. 4) We applied Maximum Effective Moment (MEM) and a crustal-scale tangential shear model to interpret the evolution from synthetic contraction to extension. Some problems still exist in the research in that we cannot determine the initial contraction time because it always developed at a shallow level. We need to compare with studies in adjacent areas that allow us to discuss the tectonic significances of late Mesozoic structures in the Daqing Shan and the northern margin of the North China Craton.

Some key geological problems in the early Precambrian Daqingshan area, Khondalite Belt, western North China Craton: SHRIMP geochronology and geochemistry (Chief Researcher: DONG Chunyan)

This project carried out research on some key issues relating to the early Precambrian geological evolution in the Daqingshan area, Inner Mongolia. Based on the geological, geochronological and geochemical data obtained in this study and previous work, we arrived at the following results. 1) Determination of the formation ages and spatial distribution of the earliest and late Paleoproterozoic supracrustal rocks, both of which were deposited between 2.50 and 2.45 Ga and between 1.95 and 2.00 Ga, respectively. Compared with late Paleoproterozoic supracrustal rocks, the earliest Paleoproterozoic supracrustal rocks are relatively small in scale, with both being different in rock assemblages and associated ores. This is the first evidence of both earliest and late Paleoproterozoic supracrustal rocks and metamorphism in the North China Craton. 2) Determination of episodic magmatism of mafic rocks and their geochemical compositions and origins. Several periods of mafic magmatism were identified during the Neoarchean to late Paleoproterozoic, including 2.55~2.5 Ga, 2.45~2.37 Ga, 2.06 Ga, 1.97~1.92 Ga, and 1.84 Ga, which suggests a much more complex evolution than previously thought. Magmatism at 2.45~2.44 Ga was identified for the first time and suggests that Daqingshan experienced an extensional regime soon after the late Neoarchean. 3) Multiple phases of felsic magmatism were revealed in the middle-late Paleoproterozoic. These include different kinds of rocks at 2.30~2.00, 1.96~1.94 Ga and 1.85~1.82 Ga with metamorphic overprints at 1.97~1.94 Ga and 1.87~1.82 Ga. The occurrence of 2.30~2.00 Ga rocks in the Daqingshan area suggests long-lived magmatism and correlates with similar rock assemblages of this period widely reported from other parts of the North China Craton. 4) Determination of multiple tectono-thermal events. Metamorphism during the late Neoarchean (~2.5 Ga), earliest Paleoproterozoic (2.4~2.45 Ga) and late Paleoproterozoic (1.83~1.96 Ga) were recorded based on U-Pb zircon geochronology. All three episodes of metamorphism are upper amphibolite-facies to granulite-facies. Almost all rocks of different ages in

the area have experienced the late Paleoproterozoic metamorphism. The late Paleoproterozoic metamorphic zircons record ages ranging from 1.96 to 1.83 Ga and suggest a long-term (>100 Ma) exhumation history in the Daqingshan area. 5) Research on metamorphic zircons revealed that most grains show at least some overgrowth; the morphology of zircon cores cannot be used as a genetic indicator of the host rocks in cases where the rocks underwent high-grade metamorphism. In some cases the U-Pb isotopic system may have been partially reset even if zircon still preserves magmatic zoning. Th/U ratios cannot always be used as a parameter to determine zircon origins.

3.2 Results of completed National Key Basic Research and Development Projects

Selection of Wench earthquake scientific drilling site (Principal Investigator: XU Zhiqin)

The "Wenchuan earthquake fault scientific drilling" project was a new start of the integral continental drilling project of China, the first project in China and the fastest in time in the world (178 days after the event), which was the best opportunity to understand the seismic mechanism, monitor the aftershocks and improve the monitoring capbilities. A detailed slip survey along the surface of the co-seismic rupture zone generally outlined the target of the WFSD sites; then high resolution geophysical prospecting and large-scale geological mapping aiming at the target areas gave a more distinctive impression of fault development and their vertical extent. Based on the general social factors and natural conditions, four drilling sites (WFSD-1, WFSD-2, WFSD-4 and WFSD-4S) and two additional sites (WFSD-3 and WFSD-3P) were eventually selected along the Yingxiu-Beichuan fault and the Anxian-Guanxian fault, respectively.

Fig. 3.2.1 Location of the WFSD-1, WFSD-2, WFSD-4 and WFSD-4S drill sites along the Yingxiu-Beichuan fault, and location of the WFSD-3 and WFSD-3P drill sites along the Anxian-Guanxian fault.

Research on the character of rupturing, tectonic evolution and large earthquake recurrence intervals in the Wenchuan earthquake fault zone (Principal Investigator: LI Haibing)

A detailed field survey has shown that the Ms 8.0 Wenchuan earthquake generated a most sophisticated and longest thrust-type co-seismic surface rupture zone; Based on coseismic striations, propagation of the earthquake as well as displacements, we reconstructed the earthquake including two subsidiary events; The Yingxiu-Beichuan fault and Guanxian-Anxian fault have symmetric and asymmetric structural characteristics, respectively; The dynamic weakening mechanisms on the Yingxiu-Beichuan fault includes melt lubrication, thermal pressurization and graphitization of amorphous carbon. The Guanxian-Anxian fault ruptured mainly by slow creep and weakened by low temperature weakening mechanisms; Combining the measurements of accumulated vertical displacements of terraces, we estimated that the recurrence interval of great earthquakes such the Ms 8.0 Wenchuan earthquake ranges from 3000 to 6000 years. In addition, ^{14}C dating of carbonaceous material from boulders gave a reccurrence interval of only 300 to 500 years.

VSP seismic profiles and construction of 3D velocity models at the drill site (Principal Investigators: YANG Wencai, YU Changqing)

The Longmenshan fault zone from northeast to the southwest along the Sichuan basin marginal distribution, extends along the fault zone Qinghai-Tibet Plain and turns round above the Sichuan basin. This is a particularly awfully crack. It is continuous for about 500 kilometers, and its width is about 70 kilometers. The scale is huge, and it has cut along the Sichuan basin. The position is extremely special because the crustal thickness changes suddenly from 60-70 km in the west to below 50 km in the east.

On May 12, 2008, the Wenchuan large earthquake hit the serious Mianyang-Beichuan County and was situated in the Longmenshan fault zone hosting the central fault. A similar disaster struck the Dujiangyan City location in the Longmenshan fault zone hosting the boundary rupture.

In order to coordinate the Wenchuan earthquake scientific drilling research, we organized three well drillings that penetrated the Wenchuan branch, and we carried out VSP vertical seismic profile gathering and material analysis. Among these, the WFSD-1 well position in the Sichuan Dujiangyan City Hongkou township, drilled to a depth of 1200 meters, the VSP gathering depth was 900 meters; The WFSD-2 well position in the Sichuan Dujiangyan City Hongkou township was drilled to a depth of 2230 meters, and VSP was gathered at 2000 meters; The WFSD-3 well position in the Sichuan Mianzhu City Jiulong town, was drilled to a depth of 1460 meters, and VSP was gathered at 1200 meters; two two-dimensional high accuracy reflection seismic cross-section in the Chenjiaba and Nanba (20 km) were made south of the dam. Through the use of many VSP images, high-accuracy reflection seismic material and seismic fabric analysis, we obtained a three dimensional underground structural model as follows: First, we obtained three precise time relations and the average velocity and the internal velocity data have provided a reliable basis for data processing and the correlation with geology. Second, through material analysis, we obtained the vertical and transverse wave speed for the well area, poisson's ratio, a vertical and horizontal wave velocity ratio below 2.5, and a poisson's ratio between 0.25 and 0.4. Third, we obtained the hole area depth portion break structure and the stratum produces the shape result, the union reflection earthquake and other geology - geophysics material, has established the well area three dimensional underground structural model, has provided the reliable basis for the following geological research.

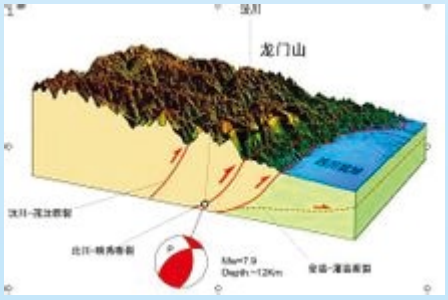


Fig. 3.2.2 Tectonic geological model of the Longmen Mountain Fault Zone

The above results indicate that, using the VSP technology a technique that unifies geological and geophysical methods, may effectively and accurately describe the subsurface geological structure and the natural change in the research area, and enhances the scientific basis for the development correlation geology research.

A seismic reflection profile across Longmen Mountain and interpretation of deep geological structures (Principal Investigators: JIANG Mei, LI Qingqing)

Some new evidence concerning the geological structures of the Longmen Mountains area is presented on the basis of seismic reflection surveys. The seismic reflection data clearly show a relatively complete stratigraphic sequence of the Upper Yangtze Basin since the Cambrian. Thrusting and nappe formation of the Songpan–Ganzi terrane onto theYangtze Plate occurred at the end of the Triassic. Folding deformation, along with movements along numerous detachment surfaces, occurred in strata among the Wenchuan–Maoxian Fault, the Yingxiu–Beichuan Fault, and the Guanxian–Anxian Fault. Based on phase transformation relationships within surface sedimentary strata, this paper interprets seismic wave characteristics of progradational and retrogradational sedimentary sequences of the Jurassic

alluvial fan to the east of the Guanxian–Anxian Fault. The Wenchuan–Maoxian Fault (WMF) is steep in the shallow strata, turns gradually gentler from a depth of 4 km, and becomes even gentler at a depths beyond 7 km. WMF imbricates with the Yingxiu–Beichuan and Guanxian–Anxian Faults, and they do not converge within the top 15 km of the crust. The gentle extensional portion of the Guanxian–Anxian Fault and the basement fault of the Western Sichuan Foreland Basin with gentle attitude (proposed for the first time in this paper) traversed in parallel the 12–20 km long dominant distribution area of aftershock foci of the 2008 Wenchuan earthquake, whereas the latter connects eastwards with the Longquan Mountains Fault, among others. The May 12, 2008 Great Wenchuan Earthquake was jointly triggered by the Guanxian–Anxian Fault and the basement fault of the Western Sichuan Foreland Basin, whereas the Yingxiu–Beichuanfault belt is the most seriously damaged and disaster-stricken portion near the hypocenters. This explains why the hypocenters are centered below the Yingxiu–Beichuanfault belt, without the need to explain the relationship between the hypocenters and the faults by assuming that the Yingxiu–Beichuan and Guanxian–Anxian Faults extend, with subvertical attitudes, to a depth of 20 km underground. Overlying the Wenchuan–Maoxian Fault through the Yingxiu–Beichuan Fault, the Pengguan complex is about 3.0–4.0 km deep, and its mass enabled prolonged accumulation of deep-seated stresses and enhances the intensity of great earthquakes. Uplift of the Longmen Mountains gave rise to stratigraphic superposition and folding, resulting in crustal shortening of about 40 km; the Longmen Mountains have risen by 3–4 km since the Mesozoic.

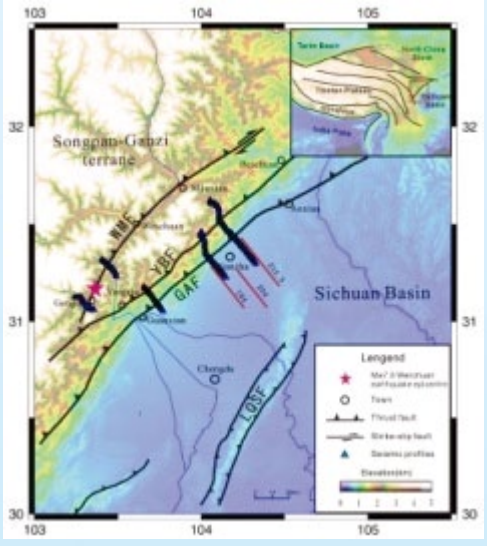


Fig. 3.2.3 Location map of Longmenshan fault belts and profiles.

WFSD-06: Petrological and mineral chemistry of seismic fault and its thermal history (Principal Investigator: ZENG Lingsen)

Funded by the Ministry of Science and Technology, this project carried out systematic investigations on the fault geometry and rupture properties of the major fault system of the 2008 Ms. 8.0 Wenchuan Earthquake, the rupture behavior, and geochemical nature of fluids involved in the rupture processes on samples both from the Wenchuan Drilling Project and from adjacent areas. Major achievements include: (1) determination of the co-seismic rupture geometries and slip distribution and the mechanism for the interactions of fault branches along the Longmeng Shan fault system (Fig. 1); (2) discovery of peculiar and interesting intergrowth structures of Ti-bearing phases and evidence of Cu-mineralization and epidotization in core samples recovered by the drilling project (Fig. 2). These findings indicate that fluids involved in the rupture processes served as a critical medium to transport high field strength elements (HFSE) as well as rare earth elements (REE); (3) documentation of step-like zircon growth in sheared granites by zircon U-Pb zircon dating (Fig. 3), which is consistent with strike-slip behavior of shear zone activity; (4) geochemical data acquired from various ductile shear zones show that fluids with complex geochemical properties were involved in deep fault movements. Such fluids are different not only in chemical compositions but also in reactivity, which would exert profound effects on shear zone behavior; and (5) modern erosion rates along the Longmen Shan area are highly heterogeneous, especially along the repeatedly ruptured areas. Strong earthquakes such as the Ms. 8.0 Wenchuan Earthquake could be a major factor to shape the topography of active mountain chains.

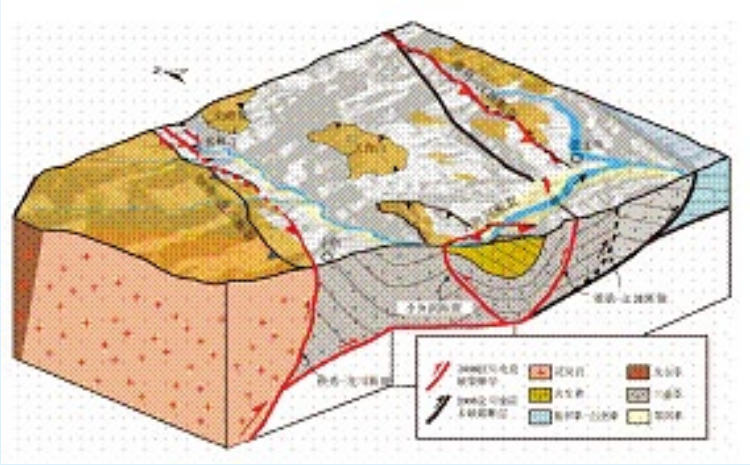


Fig. 3.2.4 3-D diagram showing fault zone interaction along the Longmen Shan Fault System.

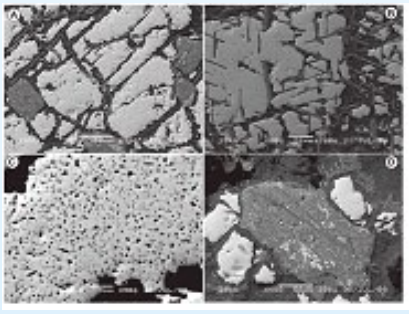


Fig. 3.2.5 Intergrowth of ilmenite and titanite in core sample recovered by the drilling project.

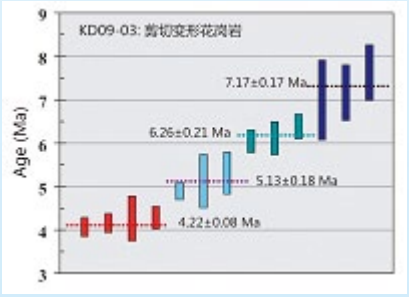


Fig. 3.2.6 Distribution of zircon U/Pb ages in sheared granite collected from the intersection of the Xianshuihe shear zone and the Longmen Shan fault system, Kangding.

3.3 Results of China Geological Survey Projects completed in 2014

Search, identification of, and research on, ancient continental material in the North China Craton (Project Leader: WAN Yusheng)

We carried out integrated geological, geochronological and geochemical studies on early Precambrian basement rocks in the Anshan-Benxi area, eastern Hebei, western Shandong, Yinshan and other areas of the North China Craton (NCC) and discovered abundant Eoarchean-Paleoarchean rocks and zircons. In the Anshan area, northeastern part of the craton, three distinct complexes with ages of 3.8–3.1 Ga (Baijiafen, Donshan and Shengousi) have been identified, along with widespread 3.1–2.5 Ga rocks of different origins and ages. In eastern Hebei Province, abundant 3.88–3.4 Ga detrital zircons were obtained from metasedimentary rocks of the Caozhuang Complex, and the oldest rock identified is a 3.4 Ga gneissic quartz diorite. Whole-rock Nd and Hf-in-zircon isotopic data from the entire NCC show similar features, documenting the addition of juvenile material to the continental crust at 3.8–3.55, 3.45, 3.35–3.3, 2.9 and 2.85–2.5 Ga with the late Mesoarchean to early Neoarchean being the most important period. Crustal recycling began as early as 3.8 Ga and continued until 3.25 Ga and appears to have played a more important role than juvenile additions between 3.25 and 2.90 Ga. Ancient crustal records obtained from deep crust beneath the NCC are similar to those in the exposed areas, with the oldest ca. 3.6 Ga rock enclaves occurring in Xinyang near the southern margin of the NCC. Based on reviews on the formation and evolution of the craton, we discussed several issues relating to the Archean NCC basement and arrive at the following major conclusions: 1) Similar to several other cratons, the late Mesoarchean to early Neoarchean was the most important period for rapid production of continental crust, and the most intensive and widespread tectono-thermal event occurred at the end of the Neoarchean. 2) In our new tectonic model we define and outline three ancient terranes containing abundant 3.8–2.6 Ga rocks, namely the Eastern Ancient Terrane, Southern Ancient Terrane and Central Ancient Terrane. This is important for further searching for ancient material, understanding plate tectonics in the late Neoarchean (2.5–2.6 Ga) and providing prospection targets for banded iron formation in the craton. 3) Vertical magmatic growth is seen as the main mechanism of crust-formation prior to the Mesoarchean. We favor a multi-island arc model related to subduction/collision and amalgamation of

different ancient terranes in the late Neoarchean. 4) The NCC may already have been a large crustal unit as a result of cratonic stabilization at the end of the late Neoarchean, probably due to magmatic underplating. This study revealed khondalites and a strong late Paleoproterozoic tectono-thermal event in the Ordos Block, a key area for establishing a tectonic model for the NCC during the late Paleoproterozoic. Some results have been published in Chemical Geology, Precambrian Research, Gondwana Research, Lithos, American Journal of Science and other journals.

New advances in the study of the Yarlung-Zangbo ophiolite belt in Tibet, China (Project Leader: YANG Jingsui)

The Yarlung-Zangbo ophiolite belt extends for nearly 2000 km E-W across southern Tibet and is composed of numerous ophiolitic massifs from Luobusa in the east to Purang in the west. These ophiolites are considered to be fragments of Neo-Tethyan oceanic lithosphere that mark the suture zone between India and Asia. Continued study of these ophiolites has led to many new discoveries regarding the nature of mantle rocks, mantle minerals and the tectonic setting of the Yarlung-Zangbo suture zone (YZSZ):

1. Mantle rocks. The Purang ophiolite in western Tibet consists of a large mantle peridotite massif with an area of ca. 600 km2. The mantle peridotites consist pre-dominantly of harzburgite, with minor amounts of lherzolite and dunite, locally cut by dikes or veins of pyroxenite, gabbro and diabase. Geochemically, the ophiolite appears to be a remnant of partially melted MOR mantle that was later altered by SSZ melts and fluids, probably in a forearc environment, indicating a multi-stage evolution.

The Dongbo ultramafic rocks have highly heterogeneous Re-Os isotopic compositions and contain some old (TRD=2.0 Ga) mantle fragments with extremely depleted Os ($^{187}Os/^{188}Os = 0.1161\pm3$) are preserved in this ophiolite.

2. Mantle minerals. Heavy mineral separation of the Purang peridotites has revealed the presence of more than fifty mineral species, including natural elements, metallic alloys, oxides, sulfides, silicates, carbonates and phosphates. Over one hundred fragments of moissanite have been recovered, and one particle is composed of a mixture of moissanite, graphite and diamond. The presence of these minerals also indicates a complex petrogenesis for the ophiolite, involving both MOR and SSZ environments.

Exotic minerals recovered from the Purang ophiolite are very similar to the ultrahigh pressure (UHP), highly reduced and crustal minerals reported from peridotites and chromitites of the Luobusa ophiolite in the far eastern part of the belt. These new discoveries have raised many questions about the origin of the Yarlung Zangbo ophiolites, their tectonic environment(s) of formation and the mantle processes involved. The widespread occurrence of these minerals in the Yarlung Zangbo ophiolites suggests that they may be widespread in ophiolite mantle rocks. The preservation of UHP and highly reduced minerals in ophiolite mantle sections is difficult to reconcile with evidence for shallow ophiolite formation.

3. Tectonic setting. Volcanic-sedimentary rocks in the Saga ophiolite of western Tibet have lithologic and geochemical similarities to those of seamount tectonic environments, emphasizing the complexity of seafloor magmatism. In western Tibet the Yarlung Zangbo ophiolite belt is split into a northern and southern belt, representing separate ocean basins.

We have identified both high-Cr and high-Al chromitites in the ophiolites of the Yarlung Zangbo belt, suggesting formation in different tectonic settings. The largest and most significant chromitite bodies occur in the Luobusa ophiolite, but many smaller chromitite ore bodies occur in the western part of the belt. They should be considered as areas in which further prospecting may reveal large, massive chromite deposits.

Paleozoic-Mesozoic tectonic transformation and related mineralization of the junction between the Qinling, Qilian and Kunlun orogens (Project Leader: YAN Zhen)

The junction between the Qinling-Qilian-Kunlun orogens (Fig. 3.3.1), which was formed and superimposed on the early Paleozoic orogen and plunged into the Qilian and Kunlun orogenic belts, is characterized by well-developed Triassic sedimentary, intermediate-acidic volcanic and granitoid rocks. Several ophiolitic mélanges occur around and within the area. The Lajishan ophiolitic mélange and arc-related volcano-sedimentary and granitic rocks formed by northward subduction of the Proto-Tethyan Ocean along the southern margin of the Central Qilian block during the Cambrian-Silurian. The Hualong Complex comprises a Neoproterozoic microcontinental fragment that rifted off the South China plate after ca. 780 Ma and a ca. 470-410 Ma continental arc. The Neoproterozoic Hualong micro-continental fragment was accreted to the north and amalgamated with the Central Qilian block during Silurian-Early Devonian, which resulted in formation of a broad accretionary complex on the SW margin of the Central Qilian terrane. Here, ca. 470-410 Ma magmatism occurred within a single northeast-facing magmatic arc that was constructed across a basement assemblage of Neoproterozoic micro-continental fragments and early Paleozoic accretionary complexes. The Neoproterozoic Hualong Complex was affected and metamorphosed episodically by ca. 470-410 Ma arc-magmatism. Detrital zircon analysis and geochemical data from sedimentary, volcanic and granitoid rocks suggest that a Triassic active continental margin developed to the south of the South Qilian terrane through northward subduction of Paleo-Tethyan oceanic lithosphere, which is characterized by volcano-magmatism, volcano-sedimentary rocks and abundant porphyry-skarn deposits. In summary, a broad subduction-accretion system was developed on the SW margin of the North China plate, comprising Neoproterozoic microcontinental fragments overprinted by an early- to late- Paleozoic accretionary complex and an Ordovician-Triassic magmatic arc.

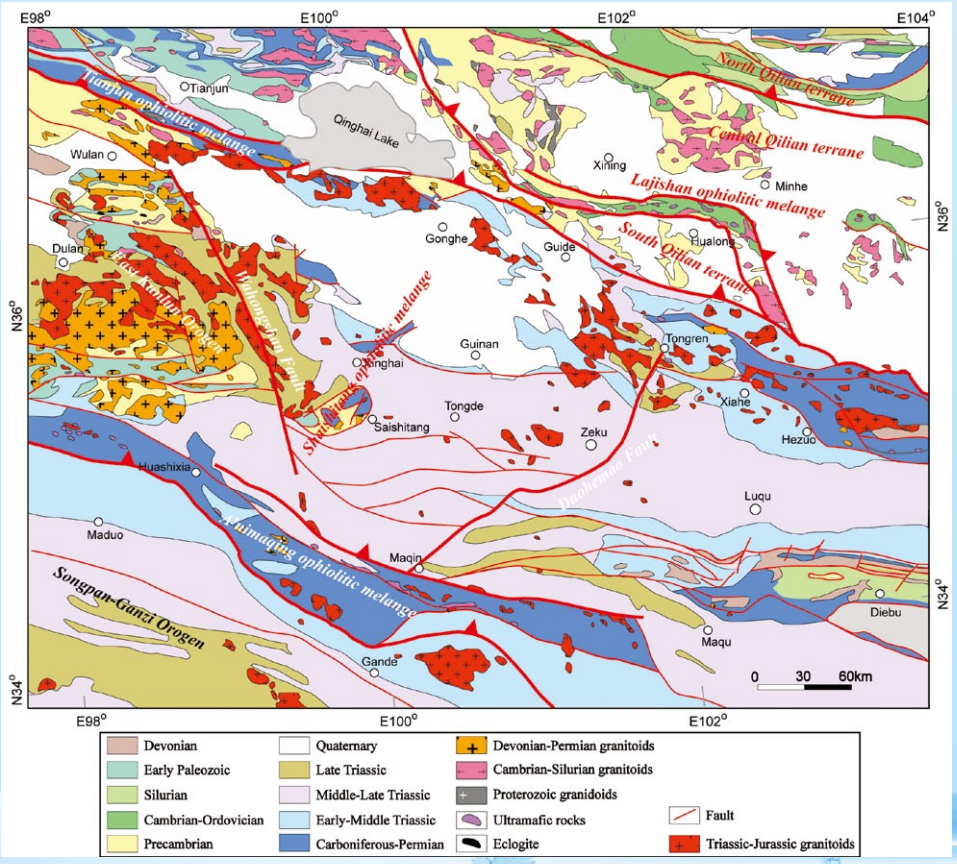


Fig. 3.3.1 Geological map of the junction of the Qinling-Qilian-Kunlun orogens.

Crustal anatexis along the Himalayan orogenic belt (Project Leader: ZENG Lingsen)

Funded by the China Geological Survey, we carried out a three-year project on "Crustal anatexis along the Himalayan orogenic belt (1212011121265)" through field and petrographic observations, combined with whole-rock geochemical and geochronological data. These new data demonstrate that: (1) The Himalayan orogenic belt experienced partial melting of thickened lower crustal rocks during incipient continental collision and resulted in the formation of Eocene high Sr/Y and Na/K granitic rocks. This finding provides important constraints on how the deep crustal rock responded to processes associated with initial continental collision tectonics; (2) the Peiku Cuo composite pluton of leucogranitic composition consists of at least two phases representing partial melting events. The earlier phase formed at 28.2±0.5 Ma with the protoliths having experienced simultaneously melting and metamorphism at 33.6±0.6 Ma, whereas the later phase formed at ~19.6 Ma; (3) The Malashan two-mica granites formed at ~18-16 Ma and were derived from fluxed-melting of metasedimentary rocks induced by E-W extension along the Malashan-Jirong branch of the N-S trending southern Tibet rift system; (4) Fluxed melting of metasedimentary rocks under high pressure (>10 kbar) conditions is another important mechanism to produce high CaO rocks of leucogranitic composition; (5) there is strong coupling between tectonics and the types of partial melting reactions in large orogenic belts such as the Himalaya.

Stratigraphic system perfection and correlation in different stratigraphic regions (Project Leader: YAO Jianxin)

Stratigraphy is playing an important role in geological research and survey. We carried out research on stratigraphic system perfection and correlation in different stratigraphic regions. The recognition of Ordovician, Silurian, Devonian, Carboniferous, Early-Middle Triassic, and Cretaceous Global Standard Stratotype-Sections and Point (GSSP) and chronostratigraphic classification standards of China are introduced in detail by systematic stratigraphy research. According to these stratigraphic standards of China and GSSP, the Ordovician, Silurian, Devonian, Carboniferous, Early-Middle Triassic and Cretaceous (O-K) stratigraphic systems of China are further improved. On the basis of recognizing relationships between interrelated stratigraphic units, the O-K stratigraphic correlation chart of regions and directions were drawn up. Based on biostratigraphic research, four radiolarian assemblage zones are recognized in the Late Jurassic –Early Cretaceous, and the Jurassic–Cretaceous biostratigraphic boundary was ascertained in South Xizang (Tibet). On the basis of research on insect fossils, Jurassic stratigraphic systems of important basins in the eastern part of China were further collated and improved, and the Jurassic stratigraphic correlation chart of important basins in the eastern part of China was drawn up. Based on research on some standard sections, the Paleogene stratigraphy of North China was subdivided in detail, the ages of the base of the Paleogene series as well as stages were confirmed, and North China has become the best region where an Asian biostratigraphic and chronostratigraphic classification framework can be established. In order to provide technical guidance for the regional geological memoir of China, the Work guide of the regional geological memoir of China was revised and re-edited, and the Jurassic and Cretaceous correlation chart for the regional stratigraphy of South China was drawn up.

Marine stratigraphic subdivision and correlation of the Paleozoic-Triassic on the Yangtze platform (Project Leader: YAO Jianxin)

Paleozoic-Triassic deposits are well developed and widely distributed on the Yangtze platform. We carried out some work on the stratigraphic subdivision and correlation of the Paleozoic-Triassic on the Yangtze platform. The Cambrian chronostratigraphic system was further improved. The recognition symbols as well as sedimentary and biotic features

of every stage of the Cambrian were ascertained in South China. A correlation of lithostratigraphy of 24 sections in the Upper Yangtze, Jiangnan slope, Jiangbei slope, Jiangnan basin, and Cathaysia stratigraphic subprovinces were established. The stratigraphic subdivision and correlation chart for the above-mentioned 24 sections was drawn up. According to investigation and survey of representative Cambrian-Ordovician boundary sections, we proposed that the Dayangcha section can be regarded as as a standard section for the Cambrian-Ordovician boundary. We re-studied and regulated the biotic recognition symbols for the Cambrian-Ordovician boundary in China. According to research on samples of the Puxihe section, Yichang, Hubei Province, a correlation between conodont zones and graptolite zones of the Lower–Middle Ordovician was improved. According to research on conodonts, the Upper Ordovician Sanbian-Katian boundary was confirmed on the Yangtze platform, and a regional correlation of conodont zones of the Baota Formation was set up. Based on research on graptolites, disagreement about the beginning and end of the Guangxi movement and the age of the Shamao Formation were discussed. The recognition symbols of Devonian Global Standard Stratotype-Sections and Points and the Devonian chronostratigraphic systems of China were improved. On the basis of research on stratigraphy, a Devonian stratigraphic correlation chart of South China and directions were drawn up.

Metamorphism and tectonic evolution of the southern Tibetan Plateau (Project Leaders: ZHANG Zeming and DONG Xin)

The Tibetan Plateau contains complex components and an evolutionary history, composed of the Songpan-Ganzi, Qiangtang, Lhasa terranes and Himalayan belt. Most previous models on the tectonic evolution of the Tibetan Plateau were based on evidence from magmatism, whereas metamorphic records were rarely considered. This project focused on metamorphic rocks and associated magmatic rocks in the southern Tibetan Plateau and led to the following progress: 1) The metamorphic rocks in the North Lhasa terrane witnessed a Neoproterozoic (~650 Ma) HP metamorphism and an early Paleozoic (~485 Ma) MP metamorphism due to closure of the Mozambique Ocean and the amalgamation of East and West Gondwana. 2) A Triassic (~220 Ma) MP metamorphic belt in the central Lhasa terrane recorded the collision of the North and South Lhasa terranes. 3) Late Cretaceous (~90 Ma) HT/MP metamorphism and Paleogene (55-30 Ma) MP amphibolite-facies metamorphism and coeval intrusion of the voluminous Gangdese Batholith in the South Lhasa terrane resulted from an Andean-type orogeny and a continental collisional orogeny. 4) Metagabbros occur as part of the Late Cretaceous Lilong Batholith in the eastern Gangdese arc and formed at 82-95 Ma. These rocks underwent 68-77 Ma granulite-facies metamorphism and nearly coeval anatexis and form the lower crustal section in a continental magmatic arc. 5) The Nyingchi Complex in the southeastern Lhasa terrane experienced intense Paleocene (66-55 Ma) subduction-related magmatism and almost synchronous granulite-facies metamorphism, accompanied by the formation of S-type granites. The Nyingchi Complex represents the exposed lower crust of the Gangdese magmatic arc and links the HT/HP granulite-facies metamorphism with felsic magmatism and crustal growth during arc accretion. 6) The Namche Barwa Complex in the Eastern Himalayan Syntaxis underwent long-lived HP/HT granulite-facies metamorphism and associated anatexis from ca. 40 Ma to 8 Ma. Dehydration melting of hydrous minerals generated the leucogranites during subduction of the Indian continent. 7) A high-temperature and high-pressure experimental study of mafic granulites shows that partial melting may have occurred in the thickened lower crust of the Tibetan Plateau. Under conditions of 15 kbar and 1000^{o}C, the produced melts have similar major element compositions as ultrapotassic adakites.

Reconstruction of rifting-reassembly processes of main continental blocks of China since the late Precambrian and constraints on Metallogenesis (Project Leader: LI Jinyi)

This project systematically studied the available data on the geology, aeromagnetics and landsat remote-sensing of the Chinese mainland, summarizing its rifting and reassembly records, features of the structural deformation since

the Mesoproterozoic, and their constraints on reconstruction of ancient geodynamic settings and tectonic evolution. 52 tectonic mixing (mélange) belts were recognized, containing ancient oceanic relics and 52 continental fragments within China were identified, putting forward a new division of continental cycles and stages of mainland China since the Mesoproterozoic. An Outline Map of Plate Tectonics of China Mainland was compiled. Furthermore, reconstruction of the tectono-paleogeography of North China, South China, and the southern margin of the Tarim block since the Mesoproterozoic was carried out and some new developments have been obtained as follows: Reconstruction of accretionary processes along the northern, western and southern margins of the North China Craton during the middle Paleozoic. Compilation of early Changchengnian (~1600 Ma), Middle Ordovician (~470 Ma), Middle Devonian (~380 Ma), Late Devonian (~355 Ma) and Early Permian (~280 Ma) tectono-paleogeographic maps of the North China continental block. This shows a change in the block size, position and geodynamic settings during several geological ages, thus reconstructing the geological history of South China during the Neoproterozoic and Phanerozoic. It was determined that the Bulunkuole Group in the West Kunlun Mountains is a suite of accretionary-collisional assemblages deposited during the Paleozoic and metamorphosed in the early Mesozoic. This was previously considered as a Paleoproterozoic metamorphic complex, and our data put forward a new subdivision of tectonic units along the southern Tarim margin and in the West Kunlun mountains.

3.4 Other important progress

Researchers from the Institute of Geology discovered a fossil record of most ancient prehistoric reptile's postpartum parental care behavior.

A research group of the Institute of Geology, led by Dr. LV Junchang discovered an oryctocoenosis of Philydrosaurus Proseilus, belonging to Diploporita Choristoderes in the Yixian Formation, Jian Chang, West Liaoning Province. The oryctocoenosis consists of six juvenile individuals around an adult. This is the oldest fossil record of Diploporita's postpartum parental care behavior. A report has been published in *Geosciences Journal* (DOI 10.1007/S12303-014-0047-1).

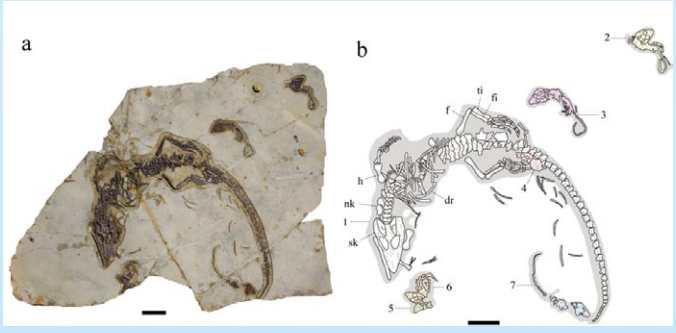


Fig. 3.4.1 Photos of Philydrosaurus proseilus (1 adult, 2-7 juveniles) (a) and diagram (b). Scale: 5 cm.

New species of Neomithes – *Poff Gansus* discovered in Jehol Biota

Dr. WANG Xuri of the Institute of Geology studied a collection of new bird specimens of the Jehol Biota (Ling-yuang Si-he-dang in Liaoning Province) which was obtained from the Beijing Museum of Natural History and in cooperation with specialists from the Natural History Museum of Los Angeles County and the Beijing Museum of Natural History, and confirmed a new species of Gansus: *Poff Gansus*, belonging to Neomithes.The study was published in *Zootaxa* 3884(3): 253-266.

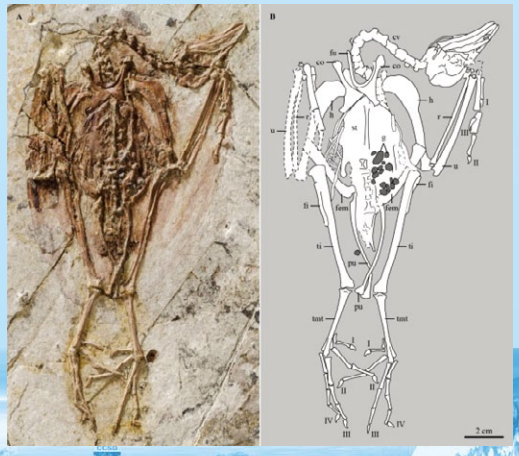


Fig. 3.4.2 Holotype of *Poff Gansus* and Bar chart

Important achievements obtained for the "Paleontology system evolution of the Chinese Ediacaran and its international correlation" Program

Dr. LIU Pengjv et al. undertook comprehensive studies on the paleontology, biostratigraphy, chemical strata, event strata, isotopic dating, etc. of the Chinese Ediacaran and obtained significant new results in paleontology as well as biostratigraphic and chronostratigraphic classification. The following are highlights of this research:

a. Many new fossils are found. Abundant microfossils were also discovered, and 3 new categories and 52 new species were recognised.

b. According to the new fossils and a comparison with previous research results, two acritarch fossil assemblages were recognized in the East Gorge Area, namely a lower *Tianzhushania* spinosa assemblage and an upper *Hocosphaeridium anozos* - *H. scaberfacium* - *T. conoideum* assemblage.

c. Hundreds of carbon and oxygen stable isotopic data were obtaimed from several newly mapped sections in the Three Gorges Area.

d. A scheme was proposed for Ediacaran stratigraphic division marked by important changes in the interface of stable carbon isotopic composition, as well as based on biological evolution stages. The Ediacaran was divided into two series and five stages, and a detailed scheme for two series and seven stages was further discussed.

The achievement has been mainly published in the *Journal of Paleontology* (Memoir 72): 1-139.

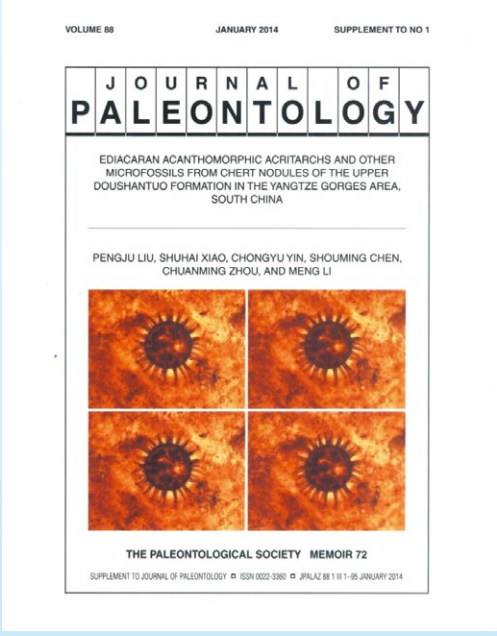


Fig. 3.4.3 Paper published by LIU Pengju (magazine covers)

Important progress obtained on the application of (U-Th)/He cryogenic thermochronological methodology in petroliferous basin research

YU Shun and CHEN Wen and colleagues of the Isotope Thermochronology Laboratory of the Institute of Geology obtained important new results in the study of the Cenozoic tectono-thermo evolution of the Kuqa Basin by applying the apatite (U-Th)/He methodology. The study showed that (U-Th)/He cryogenic thermochronology has considerable application potential in oil & gas exploration. The study was published in *Tectonophysics* 630 (2014) 166-182.

Preliminary progress in studies of the Mesoproterozoic Huade Group in the northern North China Craton

After several years of research, Dr. LIU Chaohui and his collaborators from the Institute of Geology made important progress in their studies of the Huade Group in the northern North China Craton. The results show that the Upper Huade Group formed between 1.34 and 1.32 Ga and represents the filling of a continental rift basin. The results further confirmed that the North China Craton was isolated from the Columbia supercontinent (or co-called Nunavut supercontinent) in the middle Mesoproterozoic, which is significant for investigating the position of the North China Craton when this Palaeoproterozoic supercontinent disintegrated and in reconstructing a supercontinent map. The above results were published in *Precambrian Research*, volume 254: 290-305, 2014.

A new understanding of the tectonic evolution of the early Carboniferous Epoch north of West Dzungaria, Xinjiang Province

Dr. YIN Jiyuan and his collaborators from the Isotope Thermochronology Laboratory of the Institute studied dioritic dykes in the Sawuer area, north of West Dzungaria, and found that these dykes formed during the early Carboniferous Epoch (334 Ma), with high SiO_2 (55.5-61.8 %), Al_2O_3 (14.5-16.3 %) and Sr (468-1005 ppm) content as well as a high Sr/Y (34-74) ratio and low contents of Y (10.1-14.1 ppm) and Yb (0.93-1.39 ppm), showing typical characteristics of adakites. Its time of formation is a little earlier than I type granites (332-321 Ma) in this area. These studies revealed that there are distinct differences in rock assemblage, time of formation and formation environment of dikes in the North and South of West Dzungaria, which were controlled by different tectonic systems. The data mentioned above provide a better understanding of the tectonic evolution in the late Paleozoic in the West Dzungaria region. The results were published in *Gondwana Research*. (download: http://dx.doi.org/10.1016/j.gr.2014.01.016.).

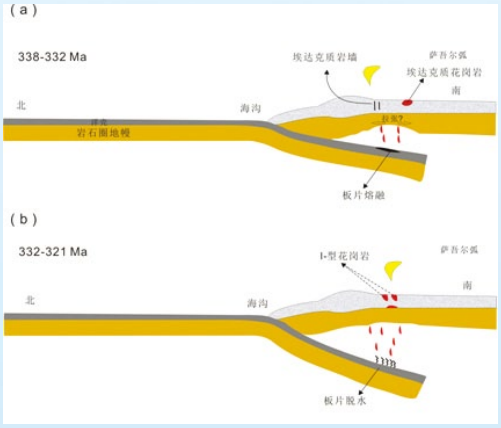


Fig. 3.4.4 Low angle subduction pattern for the early Carboniferous of North of West Dzungaria.

Progress obtained on studies of metabasites of the Daqingshan-Wulashan region, northern margin of the North China Craton

Dr. LIU Pinghua and his collaborators from the Institute carried out detailed chronological studies on metabasites of the Daqingshan-Wulashan terrane in the Khondalite Belt and put forward the idea for multiple metamorphic-magmatic events. The Daqingshan-Wulashan metabasites are related to subduction and collisional processes in a continental island arc along an active continental margin. The study led to a better understanding of the Paleoproterozoic tectonic evolution of the North China Craton and has important scientific consequences. Results of the research were published in Precambrian Research, volume 246: 334-357, 2014.

Important progress obtained in research on early Proterozoic supracrustal rocks in the Lvliang area

Assistant Research Fellow LIU Chaohui and his collaborators from the Institute have obtained important results in their study on early Proterozoic supracrustal rocks in the Lvliang area in the central North China Craton. The research revealed that a continental arc-back basin system existed during the period 2.2 to 2.1 Ga, supporting the conclusion that the North China Craton formed in the Paleoproterozinc. The results mentioned above were published in Lithos, volumes198-199: 104-117, 2014.

Progress obtained on broadband seismic observations in Cenozoic volcanic rocks of the northern Tibet Plateau

Dr. HE Rizheng and his collaborators from the Institute carried out comprehensive research on geophysical methodology for Cenozoic volcanic rocks in the northern Tibet Plateau by using broadband seismic observation techniques. They obtained a better understanding of their deep structure and causes for eruption, which improved the

prospects for oil & gas resource evaluation and uplift studies in the northern Tibet Plateau.

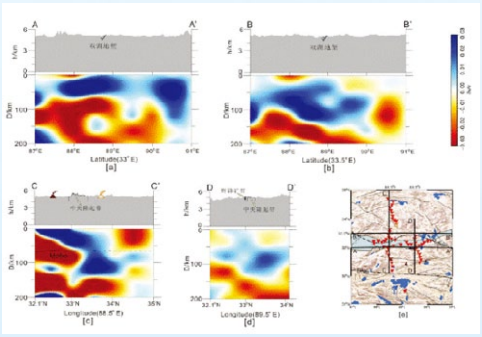


Fig. 3.4.5 Deep structural characteristics beneath the Qiangtang oil and gas basin in northern Tibet.

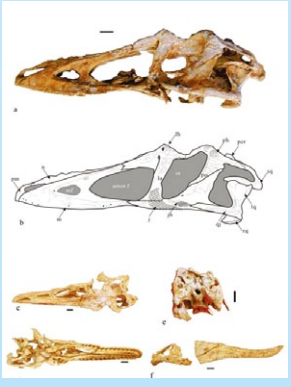
Researchers from the Institute of Geology confirmed that the southern part of the eastern Liupanshan piedmont fault zone is still active

Dr. SHI Zhigang et al. from the Institute accurately determined the age of latest activity in the southern part of the eastern Liupanshan piedmont fault zone by studying sedimentary rhythms of active faults grooves. These studies revealed that several events occurred in the southern part of the eastern Liupanshan piedmont fault zone since the Late Pleistocene and the zone is still an active fault zone. The results are significant for studies of deformation and uplift in the Tibetan Plateau, as well as for earthquake research.

The original Taihua sequence in the Lushan area of Henan Province has been redefined as Taihua Complex and Lushan rocks

Based on geological studies and new isotopic dating, Academician SHEN Qihan et al. of the Institute subdivided the original Taihua sequence in the Lushan area of Henan Province into an upper series named 'Lushan rocks' which mainly consist of Paleoproterozoic metamorphic supracrustal rocks that are in unconformable contact with a lower sequence now named 'Taihua Complex' that mainly consists of Mesoarchean TTG rocks. Relevant papers were published in the *Journal of Stratigraphy*, volume 38: 1-7, 2014.

A new clade of Tyrannosaurids, Qianzhousaurus Sinensis discovered in Ganzhou, Jiangxi Province



A joint research group consisting of scientists from the UK and China, led by Senior Research Fellow LV Junchang from the Institute, discovered a new clade of Late Cretaceous long-snouted Tyrannosaurids, Qianzhousaurus Sinensis. The study was published in 'Nature Communications in 2014: LV Junchang, YI Laiping, Brusatte Stephen L., YANG Ling, LI Hua & CHEN Liu. A new clade of Asian Late Cretaceous long-snouted tyrannosaurids. NATURE COMMUNICATIONS vol.5, 3788, doi: 10.1038/ncomms4788.

Fig. 3.4.6 Skull and jaw of Qianzhousaurus (Scale 5 cm).

Significant breakthrough achieved in the correlation of international stratigraphic classification of the Meso-Neoproterozoic in Asia

In order to solve the world-wide disagreement on chronological correlation in stratigraphic classification of the

Mesoproterozoic Erathem, the research group of 'China-Russia-Mongolia-Kazakhstan-Republic of Korea' International Cooperative Mapping Project from the Institute of Geology put forward a scheme to redefine the global lower boundary age for Mesoproterozoic at 1700 Ma, based on field investigations and comprehensive studies, which has now been recognized by the scientific community. This was achieved after systematic research on isotope geochronology of the Meso-Neoproterozoic Erathem during the past 10 years and a significant breakthrough in the correlation of International Stratigraphic Classification of Meso-Neoproterozoic rocks in Asia. This is an important contribution to the modification of the International chronostratigraphic chart.

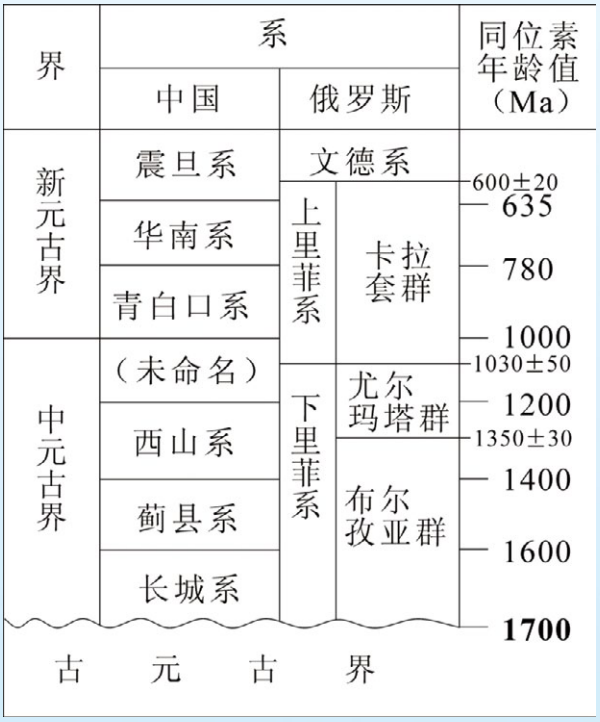


Fig. 3.4.7 Abbreviated chart for correlation of international stratigraphic classification of the Meso-Neoproterozoic.

The project "Tectonic environment of major ophiolites in the western region of China" yielded significant results

The goals and mission of the project "Tectonic environment of major ophiolites in the western region of China" were achieved within four years of scientific efforts, and numerous results were obtained. The project compiled a tectonic map of ophiolites in the western region of China and published 14 papers in important domestic and international journals (including 10 international SCI papers).

The project was launched in 2009, and during its execution the members undertook numerous field studies, including the hinterland of the Tibetan Plateau, the Kunlun Mountains, the Tianshan Mountains, the Dzungaria and Qilian Mountains, etc. In the project launch year of 2009, 80-year old Academician XIAO Xuchang went to Tibet to carry out fieldwork along the Yarlung Zangbo suture zone.

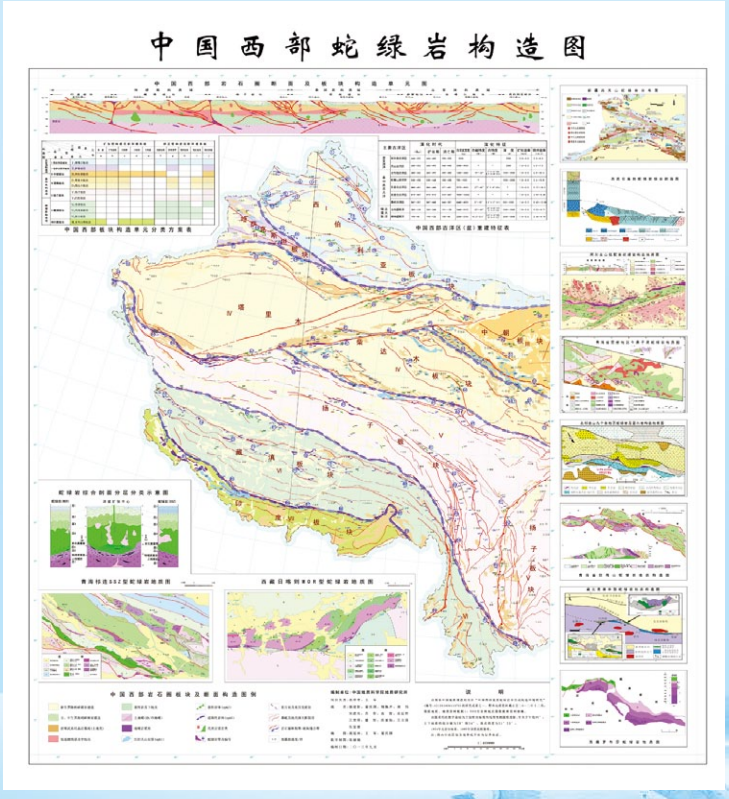


Fig. 3.4.8 Tectonic map of ophiolites in the western region of China.

3.5 Important Scientific Rewards

One project won the first grade award of the Ministry of Land and Resources, China (the Institute of Geology was ranked second):

Tectonics, evolution and mineralization of the Qinling orogen (YAN Zhen et al.)

One project won the first grade award of the Beijing Municipal Government (the Institute of Geology was ranked second):

Research on macroevolution and diversity of important vertebrate in Yanliao - Jehol Biota (JI Qiang, JI Shu'an, LV Junchang, YUAN Chongxi et al.)

Two research projects were recognized as "Ten Great Scientific Achievements of the Chinese Academy of Geological Sciences and China Geological Survey in 2014":

Rank 8: Crustal structure and evolution of the ancient North China Craton (WAN Yusheng, DONG Chunyan, XIE Hangqiang, ZHENG Jianping, LIU Shoujie, MA Mingzhu, XIE Shiwen, REN Peng, SUN Huiyi, LIU Dunyi et al.)

We carried out integrated geological, geochronological and geochemical studies on typical early Precambrian areas of the North China Craton such as Anshan-Benxi, eastern Hebei, western Shandong and Yinshan, and synthesized the general geological records of the Archean basement relating to Archean crust formation and evolution of the North China Craton. This study also revealed that the Ordos basement was involved in an extensive late Paleoproterozoic tectono-thermal event. We defined and outlined three ancient terranes containing abundant 3.8–2.6 Ga rocks for the first time in the North China Craton, namely the Eastern Ancient Terrane, Southern Ancient Terrane and Central Ancient Terrane.

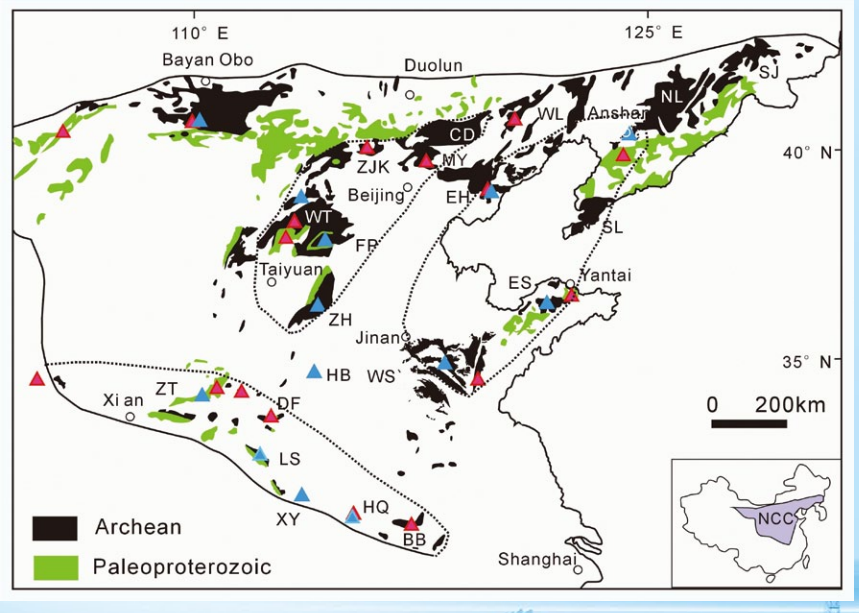


Fig 3.5.1 Distribution of ancient (>2.6 Ga) terraces in the North China Craton

Rank 10:Key progress on research on the Wenchuan earthquake fault (LI Haibing, SI Jialiang, LIU Dongliang, SUN Zhiming, WANG Huan, FU Xiaofang, HOU Liwei, PEI Junling, LIU Jiang, GONG Zheng, HAN Liang, PAN Jiawei, YANG Guang, ZHANG Wei, LI Chenglong, ZHANG Jiajia, YUN Kun, ZHANG Wenjing et al.)

Funded by the Ministry of Science and Technology project, the National Natural Science Foundation of China project, and the China Geological Survey project, the research group lead by Prof. LI Haibing, undertook comprehensive research on seismic faulting of the Wenchuan Earthquake fault. First, the principal slip zone of the Wenchuan earthquake was determined by detailed research based on the WFSD-1 core and outcrop investigations. The Wenchuan earthquake fault zone (Yingxiu-Beichuan fault zone) has been confirmed to be 105-240 m wide and consists of 5 different units with different fault rocks, where seismic events occurred repeatedly with multiple coseismic fault weakening effects. Second, the dynamic weakening and frictional behavior of the Wenchuan earthquake fault were analyzed by long-term temperature monitoring. The lowest dynamic frictional coefficient (0.02) was measured in nature. Third, we recorded signals showing quick fault healing by long-term hydrological monitoring that revealed variations on permeability along the Wenchuan fault zone. These results not only directly answer key questions puzzling geologists and seismophysicists area for decades, but are also significant for improving the seismic fault theory and understanding the Wenchuan earthquake fault mechanisms. Our work can be considered as a theoretical basis for seismic prevention and disaster mitigation.

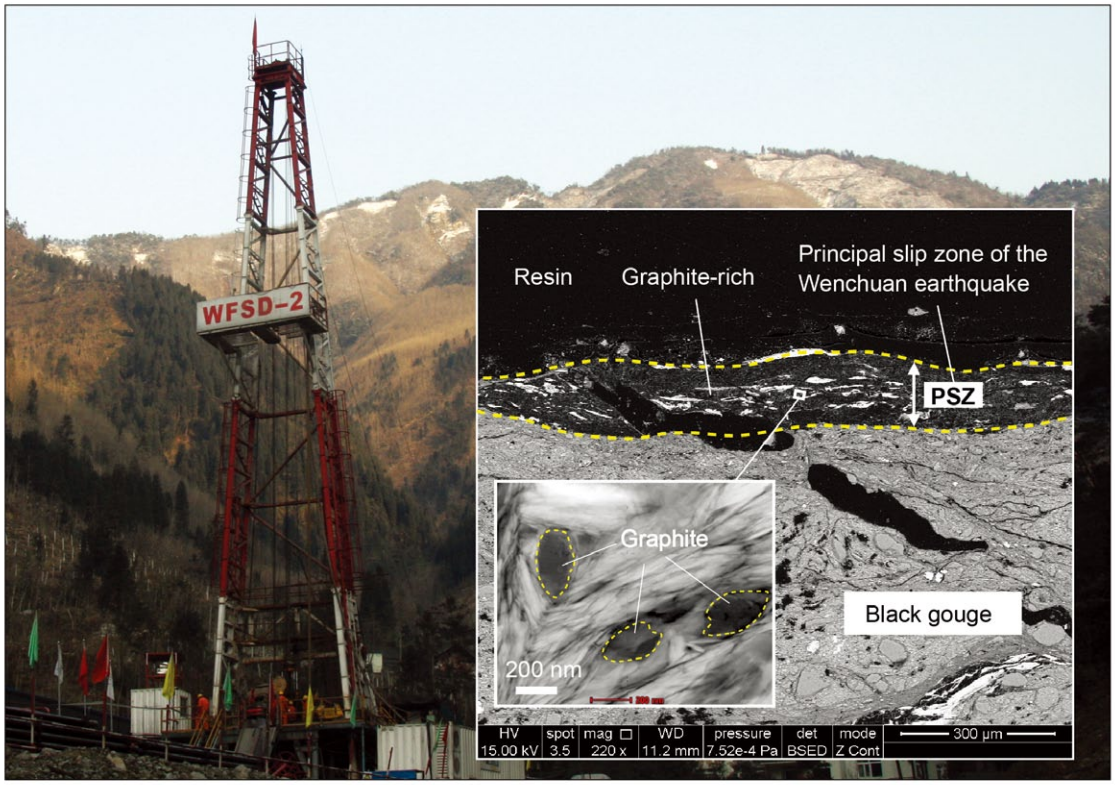


Fig 3.5.2. The Wenchuan earthquake principal slip zone (PSZ) in the Wenchaun earthquake Fault Scientific Drilling (WFSD) core. The PSZ is 100~200 µm wide and locally rich in nanoparticles of graphite, suggesting that thermal pressurization played the main role during fault slip with an extremely low fault strength. The enrichment in graphite along localized slip zones could be used as an indicator of transient frictional heating during seismic slip in the upper crust.

4. International Cooperation and Academic Exchange

4.1 Attendance at International Conferences

REN Jishun, JIN Xiaochi and ZHAO Lei attended the Bureau Meeting and General Assembly of the Commission for the Geological Map of the World (CGMW) (Paris, France)

Invited by Dr. Philippe ROSSI, President of CGMW and Dr. Manuel PUBELLIER, Secretary General of CGMW, Academician REN Jishun, Dr. JIN Xiaochi and Dr. ZHAO Lei attended the CGMW Bureau Meeting, the CGMW General Assembly and the Meeting on Tectonic Maps held on February 19, 20-21 and 22, 2014 respectively in Paris, France. More than hundred geoscientists from nine CGWM regional subcommissions and four specialized subcommissions were present at the General Assembly, which reviewed the work conducted since 2012 and passed the Resolutions 2014 of CGMW.

Fig. 4.1.1 Academician REN Jishun (first from right) and Researcher JIN Xiaochi (second from right) attending the CGMW meeting.

Fig. 4.1.2 JIN Xiaochi (first from left) giving a presentation at the meeting.

ZHU Xiangkun and colleagues attended the 2014 Goldschmidt Conference (Sacramento, USA)

Invited by Dr. Seth DAVIS, Chief Operating Officer of the Geochemical Society, Researcher ZHU Xiangkun and Assistant Researchers LI Jin, LI Shizhen, SUN Jian and DONG Xin attended the 2014 Goldschmidt Conference held on June 8-13, in Sacramento, USA. They delivered the following presentations at the meeting: Mesoproterozoic Mn mineralisation in the North China Craton and its paleo-oceanographic significance (ZHU Xiangkun); High-precision measurements of molybdenum isotopic compositions of geochemical reference materials (LI Jin); Cu isotope fractionation during weathering of basalt (LI Shizhen); Fe-Nd- isotopes and trace element geochemistry of the Neoproterozoic iron formation in Xinyu, Yangtze region, China (SUN Jian); and Multistage Cenozoic adakitic granitoids from the southeastern Gangdese belt, south Tibet, and their tectonic significance (DONG Xin).

Fig. 4.1.3 Group photo of attendees from the Institute.

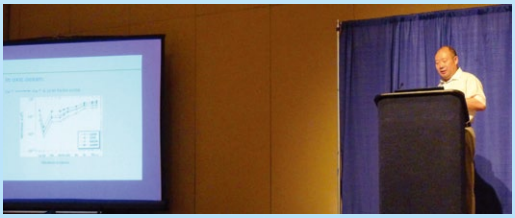


Fig. 4.1.4 ZHU Xiangkun giving a presentation at the conference.

YOU Guoqing and REN Liudong attended the 2014 Global Petroleum Show (Calgary, Canada)

Researchers YOU Guoqing and REN Liudong attended the 2014 Global Petroleum Show held on June 9-13 in Calgary, Canada. They also visited the Geosciences Department of the University of Calgary.

Fig. 4.1.5 Location of the 2014 Global Petroleum Show.

Fig. 4.1.6 REN Liudong (first from right) communicating with experts from the University of Calgary.

LI Tingdong and colleagues attended the 12th International Workshop on the Cooperative Project "Deep processes and metallogeny of Northern-Central-Eastern Asia" (Daejeon, Korea)

Invited by Dr. Kyu Han KIM, President of the Korea Institute of Geoscience and Mineral Resources (KIGAM), Academician LI Tingdong, Researchers DING Xiaozhong, REN Liudong, LIU Yanxue, YOU Guoqing and Associate Researcher WANG Jun, headed by Prof. DONG Shuwen of the Chinese Academy of Geological Sciences (CAGS), attended the 12th International Workshop on the Cooperative Project "Deep processes and metallogeny of Northern-Central-Eastern Asia" held on September 14-20, 2014, in Daejeon, Korea.

Fig.4.1.8. Leaders of the delegations from five countries signing a memorandum for the 12th International Workshop.

Fig. 4.1.7 Members of the CAGS delegation giving presentations at 12th International Workshop.

JIN Xiaochi attended the 3rd International Symposium of IGCP-589: Development of the Asian Tethyan Realm: Genesis, processes and outcomes (Tehran, Iran)

The 3rd International Symposium of IGCP-589: "Development of the Asian Tethyan Realm: Genesis, processes and outcomes" was held in Tehran, Iran, on October 21-26, 2014. As the IGCP-589 Project leader, Researcher JIN Xiaochi hosted the first session of the symposium and delivered an oral presentation entitled "Permian sedimentary development of the Baoshan and Tengchong blocks in western Yunnan, China". He also participated in a field excursion after the symposium.

YANG Jingsui and colleagues attended the 2014 Fall Meeting of the American Geophysical Union (AGU) in San Francisco, USA

The 2014 Fall Meeting of the American Geophysical Union (AGU) was held on December 15-19, in San Francisco, USA. Researchers YANG Jingsui, LI Haibing, WANG Tao, YU Changqing and Marie-Luce CHEVALIER attended the meeting and delivered their presentations as follows: Genesis of diamond-bearing and diamond-free podiform chromitites in the Luobusa Ophiolite, Tibet (YANG Jingsui); Late Mesozoic ductile detachment zones in continental NE Asia: implications for polarity and processes of crustal extension (WANG Tao); Different surface ruptures and dynamics between the 2008 and 2014 Ms 7.3 Yutian earthquakes in the western segment of the Altyn Tagh fault, western Tibet (LI Haibing); Relations between natural gas hydrate and structure on Muli basin (YU Changqing); and Quantification of both normal and right-lateral late Quaternary activity along the Kongur Shan extensional, Chinese Pamir (Marie-Luce CHEVALIER).

Fig. 4.1.9. YANG Jingsui giving an oral presentation at the meeting.

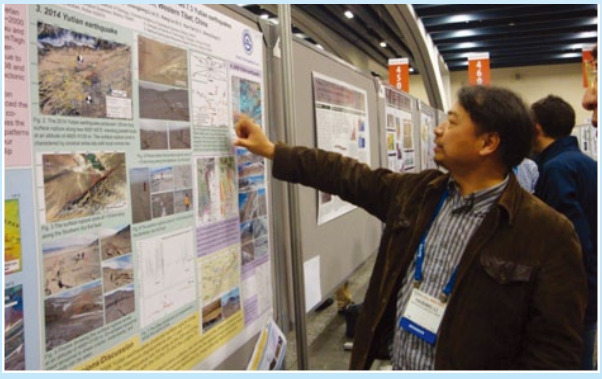


Fig. 4.1.10 LI Haibing giving a poster presentation at the meeting.

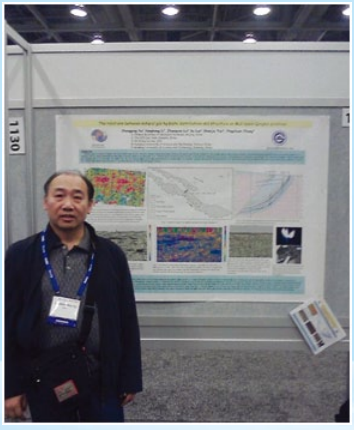


Fig. 4.1.11 YU Changqing and his poster at the meeting.

Fig. 4.1.12 WANG Tao attending one of the sessions of the meeting.

4.2 Foreign visits by members of the Institute

HE Zhenyu visited the University of Erlangen, Germany

Invited by Prof. Reiner KLEMD of the University of Erlangen, Germany, Associate Researcher HE Zhenyu visited the GeoZentrum Nordbayern at this university to conduct a cooperative study on the petrogenesis of a volcano-plutonic complex from SE China in the laboratory in Erlangen from May 5-25, 2014.

Fig. 4.2.1 HE Zhenyu working in the laboratory of the University of Erlangen.

TONG Ying conducted cooperative research at the National Taiwan University (Taipei, Taiwan)

Invited by Prof. Bor-ming JAHN of National Taiwan University (NTU), Associate Researcher TONG Ying visited this university to conduct a cooperative research, during February 14 to July 31, 2014. During his stay at NTU he wrote a manuscript entitled "Permian alkaline granites in the Erenhot-Hegenshan Belt, northern Inner Mongolia, China: model of generation, time of emplacement and regional tectonic significance" which was then published in the *Journal of Asian Earth Sciences*.

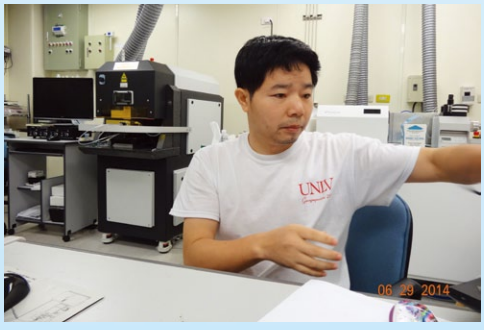


Fig. 4.2.2 TONG Ying working at the Laboratory of NTU.

HOU Zengqian and colleagues conducted field work in Iran

Invited by Prof. Mehraj AGHAZADEH of Payam Noor University, Tehran, Iran, a delegation headed by Researcher HOU Zengqian (Researcher YANG Tiannan, Associate Researchers YANG Zhiming and SONG Yucai, Assistant Researchers ZHANG Hongrui and LIU Yingchao included) conducted field work in Iran during June 28 to July 22, 2014.

Fig. 4.2.3 Cretaceous basalts showing distinct columnar joints.

Fig. 4.2.4 Open pit of the largest MVT Pb-Zn deposit at Angouran, Iran

JIN Xiaochi conducted evaluation for the qualification of two Japanese Geoparks (Japan)

Entrusted by the Global Geoparks Network (GGN) Secretariat at UNESCO and invited by Dr. Akira KATAYAMA, Coordinator of the AsoGeopark Promotion Council, and Dr. Katsunori ISHIDA, Director of the San'inKaiganGeopark Promotion Council, Researcher JIN Xiaochi, together with Dr. Maurizio BURLANDO, an expert from Italy, conducted an evaluation for the qualification of the abovementioned two Geoparks. This evaluation will be made every four years.

MENG Fancong took part in joint research in the Institute of Geology and Geochemistry, Ural Branch of the Russian Academy of Sciences and field trips in the Polar Urals (Russia)

Invited by Dr. V.P. SHMELEV of the Institute of Geology and Geochemistry, Ural Branch of the Russian Academy of Sciences, Researcher MENG Fancong took part in joint research in the laboratories of this institute and field trips entitled "the Rai-Iz ophiolite complex and related chromite deposits, Polar Urals" in Polar Urals from July 25-August 13, 2014.

Fig.4.2.5 Group photo during the field trip.

Fig.4.2.6 Visiting the local drill core store.

LI Yibing participated in the Integrated Ocean Drilling Program Izu-Bonin Mariana Forearc Expedition 352 (Western Pacific Ocean)

Invited by the United States Implementing Organization (USIO), Dr. LI Yibing participated as Inorganic Geochemist in the Integrated Ocean Drilling Program Izu-Bonin Mariana Forearc Expedition 352 from July 29 to September 29, 2014.

Fig.4.2.7 the IODP LEG 352 ship "JOIDES Resolution".

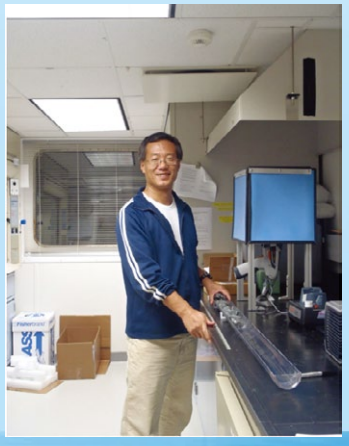


Fig.4.2.8 LI Yibing doing XRF tests of the drill cores.

LIU Fulai and WANG Fang undertook U-Pb dating and trace element analyses in the Institute of Geoscience, J. W. Goethe University (Frankfurt am Main, Germany)

Invited by Dr. Axel GERDES of the Institute of Geoscience, J. W. Goethe University, Frankfurt am Main, Researcher LIU Fulai and Assistant Researcher WANG Fang visited this institute and undertook U-Pb dating and trace element analyses of monazite, xenotime, thorite, etc. from August 5 to 18, 2014.

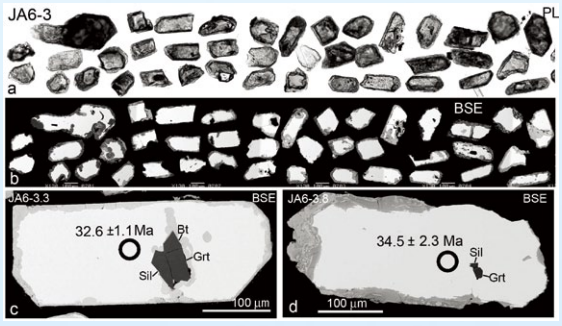


Fig.4.2.9 BSE image of the Sanjiang Complex zone thorites and result of U-Th-Pb dating.

WANG Tao and colleagues undertook a geological field trip to northern Saskatchewan and 3D facility training at the Saskatchewan Geological Survey (Saskatoon, Canada)

Under the terms of the Memorandum of Understanding (MOU), signed between the Saskatchewan Geological Survey, Saskatchewan Ministry of the Economy, Canada, and the China Geological Survey in May 2013, and invited by Dr. Gary DELANEY, Chief Geologist of Saskatchewan Geological Survey, Researchers WANG Tao and GUAN Ye, Associate Researcher GUO Lei, Dr. ZHANG Yinghui, together with Dr. MAO Xiaochang of China Geological Survey visited the Province of Saskatchewan from August 13 to 20, 2014 to undertake a geological field trip to northern Saskatchewan and 3D facility training and academic exchange (Dr. ZHANG Yinghui stayed there for one month to work on the cooperative 3D geological modeling projects).

Fig.4.2.10 Visiting the drill core stores of Saskatchewan.

Fig.4.2.11 During the field trip to Flin Flon (ore district).

TONG Ying and GUO Lei participated in a joint field trip to southern and eastern Mongolia

Invited by Dr. D. Odgerel D and Academician O. TOMURTOGOO of the Institute of Geology and Mineral Resources, Mongolian Academy of Sciences, Associate Researcher TONG Ying and Assistant Researcher GUO Lei visited South and East Mongolia from September 2 to October 1, 2014.

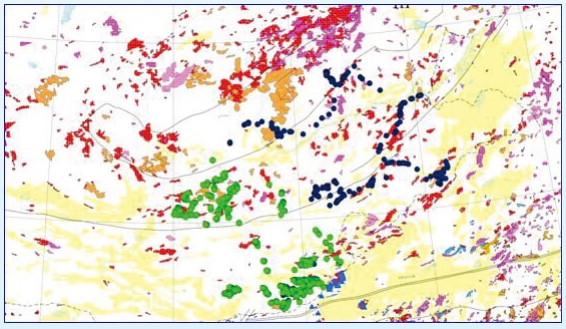


Fig. 4.2.12. Geological map of South and East Mongolia, in which the green dots show the locations visited.

Fig. 4.2.13. Group photo during the field trip.

LIU Pengju visited the Department of Earth Science and Palaeobiology, Uppsala University and took part in studies (Uppsala, Sweden)

Invited by Prof. Malgorzata MOCZYDLOWSKA-VIDAL of the Department of Earth Science and Palaeobiology, Uppsala University, Researcher LIU Pengju visited this department as a guest researcher and took part in studies on biological affinities and phylogeny of organic-walled microfossils and the chronostratigraphy of the Ediacaran System from November 4 to December 1, 2014.

Fig.4.2.14. Group photo of LIU Pengju and Prof. MOCZYDLOWSKA-VIDAL.

XIONG Fahui visited the Helmholtz GFZ German Research Centre for Geosciences in Potsdam, Germany

Invited by Prof. Wilhelm HEINRICH of the Helmholtz GFZ German Research Centre for Geosciences, in Potsdam, Dr. XIONG Fahui visited this Centre and worked on the project “Combined FIB/TEM studies on diamonds from ophiolites” from November 1 to December 14, 2014.

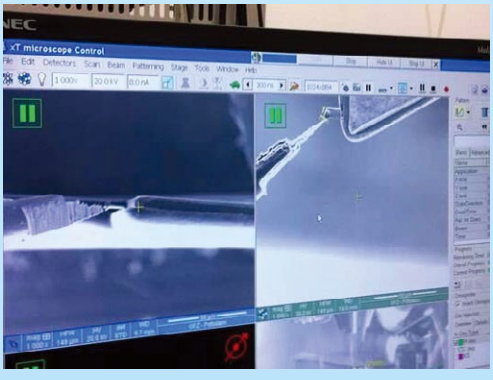


Fig.4.2.15 Process of taking a foil of 500 nm in width from a Tibet diamond.

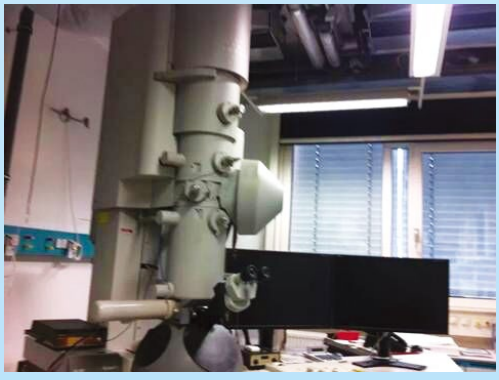


Fig.4.2.16 TEM analyses the foil 500 nm in width.

HE Rizheng worked as a Visiting Research Scientist at the Department of Earth, Atmospheric, and Planetary Sciences (EAPS) at the Massachusetts Institute of Technology (Massachusetts, USA)

Invited by Prof. Robert van der HILST of the Department of Earth, Atmospheric, and Planetary Sciences (EAPS) at the Massachusetts Institute of Technology, Researcher HE Rizheng worked as a Visiting Research Scientist on the joint interpretation of seismic and gravity data and participated in other academic and research activities from March 20, 2013 to May 21, 2014.

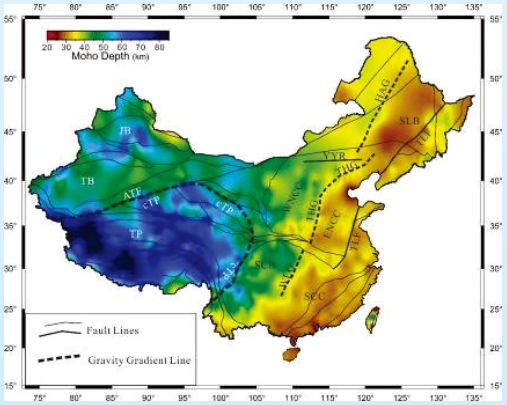


Fig.4.2.17. Moho depth under the Chinese mainland.

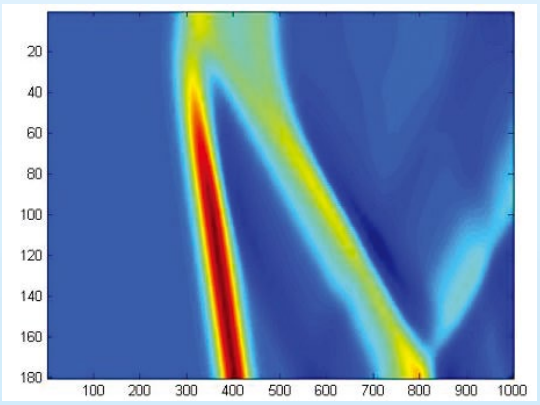


Fig.4.2.18. Forward modeling of seismic waves' travelling in a homogeneous medium.

YANG Zhiming carried out collaborative research at the Economic Geology Research Center, James Cook University (Townsville, Australia)

Invited by Prof. CHANG Zhaoshan of the Economic Geology Research Center (EGRU), James Cook University, Australia, Associate Researcher YANG Zhiming visited EGRU as a visiting scholar and carried out collaborative research on the genesis of porphyry Cu-Mo deposits in a post-collisional setting from July 28, 2013 to June 3, 2014.

Fig.4.2.19. YANG Zhiming conducting zircon Hf isotopic analysis at the Advanced Analytical Centre, James Cook University.

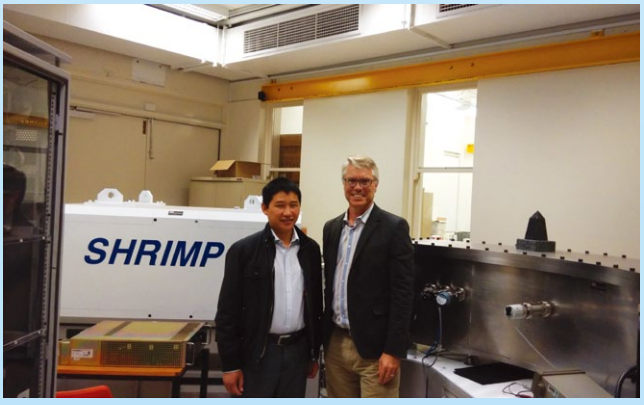


Fig.4.2.20. YANG Zhiming visiting the John de Laeter Centre, Curtin University, Perth, hosted by Professor Brent McInnes, Director of the Centre.

LIU Shoujie conducted collaborative research at the Department of Geosciences, National Taiwan University (Taipei, Taiwan)

Invited by Prof. Bor-ming JAHN of the Department of Geosciences, National Taiwan University, Dr. LIU Shoujie conducted collaborative research on the project of "Accretionary orogens in Asia and growth of the continental crust in the Phanerozoic– further study in the Central Asian Orogenic Belt and continuous investigation in the Northeast Asian Orogenic Belt (NE Japan, Hokkaido, and Russian Far-East) " from October 21, 2013 to July 31, 2014.

CAO Hui conducted cooperative research in the laboratory of Louisiana State University (Baton Rouge, USA)

Invited by Prof. Alexander WEBB of the Louisiana State University, as a visiting researcher, Dr. CAO Hui conducted scientific exchange on the tectonic evolution of orogenic belts in southwestern China and worked together with Prof. Webb in the laboratory of this university on the collected samples during November 15, 2014 to January 14, 2015.

Fig. 4.2.21. SEM (with both FIB and EBSD) of the laboratory of Louisiana State University.

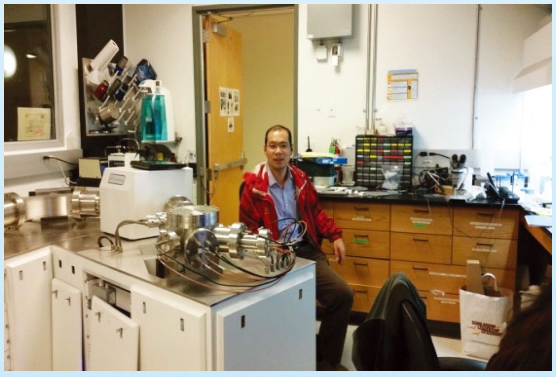


Fig. 4.2.22. Visiting the Laboratory of the University of California, Santa Barbara (UCSB).

LU Minjie and colleagues conducted geological investigation in Bolivia and Chile (Bolivia and Chile)

Invited by Dr. Enrique VIVEROS, Deputy Secretary-General of Sociedad Nacional De Mineria De Chile and Dr. Jaime Villalobos SANJINES of Minera Alcira S. A. of Bolivia, Researcher LU Minjie, Deputy Director-General of the Institute, and Assistant Researcher ZHU Xiaosan conducted geological investigations in Bolivia and Chile, during December 6 to 26, 2014, studying typical ore deposits of the two countries.

Fig. 4.2.23 At Cerro Rico (an Ag-Sn mine) of Bolivia.

Fig. 4.2.24. Group photo with the Bolivian counterparts of the Bolivia National Bureau of Geology and Mineral Resources (Servicio Geológico Minero).

GAO Rui and LU Zhanwu worked with American experts on CMP data processing and interpretation of data from SinoProbe profiles (Stanford, Houston and San Francisco, USA)

Invited by Prof. Simon KLEMPERER of Stanford University, Prof. Fenglin NIU of Rice University, and Dr. Dezhi CHU of Exxon Mobil Exploration Company, Researcher GAO Rui and Associate Researcher LU Zhanwu worked together with the above-mentioned experts on CMP data processing and interpretation of the data from SinoProbe profiles during December 1 to 31, 2014.

They also attended the 2014 Fall Meeting of the American Geophysical Union (AGU) and delivered their presentations entitled "Deep structures beneath the Karakoram Fault revealed by SINOPROBE deep seismic reflection profile" (LU Zhanwu), "Seismic evidence for North China plate subduction beneath northeastern Tibet and its implications for plateau growth" and "Structural deformation of the Minjiang and Huya Fault, Eastern Margin of the Tibetan Plateau, Revealed by Deep Seismic Reflection Profiling" (GAO Rui).

Fig. 4.2.25. Discussing the interpretation of the IYS deep seismic reflection profiles with Prof. Simon of Stanford University.

Fig. 4.2.26 Discussing the deep seismic reflection profiles in the northeastern Tibetan Plateau with Prof. Larry Brown of Cornell University.

LI Qiusheng visited the Department of Earth Sciences, National Central University (Taoyuan, Taiwan)

Invited by Assistant Prof. KUO Chenhao of the Department of Earth Sciences, National Central University (NCU), Researcher LI Qiusheng visited this Department and conducted academic exchanges from December 29 to 31, 2014.

Fig. 4.2.27. LI Qiusheng giving a presentation at NCU.

ZHANG Wenjing conducted tests at the Department of Geosciences, National Taiwan University (Taipei, Taiwan)

Invited by Prof. SONG Shengrong of the Department of Geosciences, National Taiwan University, Dr. ZHANG Wenjing visited this Department and conducted tests on samples of the Wenchuan Fault Scientific Drilling Program (WFSD) from November 4, 2014 to January 2, 2015.

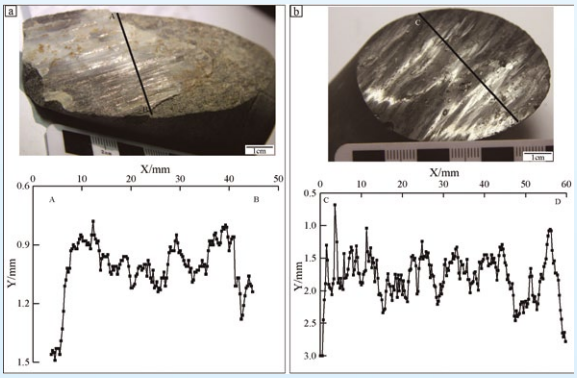


Fig. 4.2.28. Roughness of rupture mirror with slickensides.

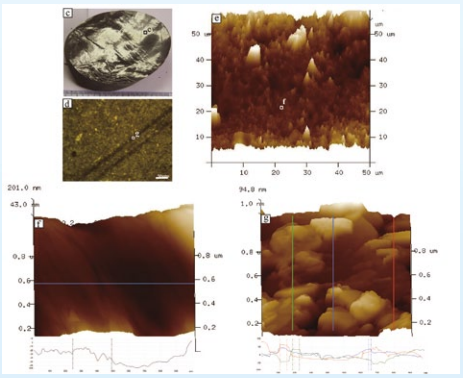


Fig. 4.2.29. AFM picture and roughness of rupture mirror without slickensides.

ZHAI Qingguo worked in the laboratory of Rice University (Huston, USA)

Invited by Prof. Cin-Ty LEE of the Department of Earth Sciences, Rice University, Associate Researcher ZHAI Qingguo worked in the laboratory of this university on Tibetan geochemistry from August 21, 2014 to February 2, 2015.

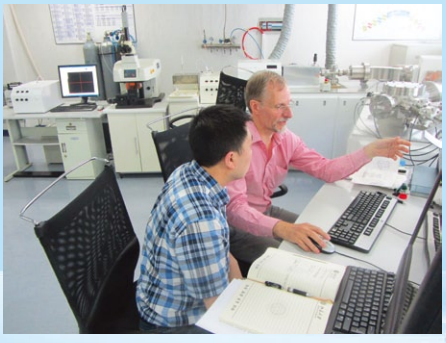
4.3 Academic Visitors

Visit of David LEACH from the U.S. Geological Survey

Invited by Associate Researcher SONG Yucai, Dr. David LEACH, former researcher of the U.S. Geological Survey, who is an Honorary Professor of the Institute of Geology, conducted field work in Yunnan Province, China during February 27 to March 19, 2014, together with SONG Yucai and several other team members.

Fig.4.3.1 Discussion during the field trip (Dr. LEACH, second from left)

Visit of Nicholas Stanley BELSHAW from Oxford University, UK



Invited by Researcher ZHU Xiangkun, Dr. Nicholas Stanley BELSHAW of Oxford University, UK, visited the Laboratory of Isotope Geology of the Institute of Geology, on April 13-17, 2014, for academic exchanges.

Fig.4.3.2. Dr. Nicholas Stanley Belshaw working at the Laboratory of Isotope Geology.

Visit of B. Ronald FROST from University of Wyoming, USA

Invited by Researcher WU Cailai, Prof. B. Ronald FROST of University of Wyoming, USA, visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute, during May 20 to June 4, 2014, for academic exchanges.

Fig.4.3.3. Prof. B. Ronald Frost giving a presentation at the State Key Laboratory of Continental Tectonics and Dynamics.

Visit of James WHITE from the University of Otago, New Zealand

Invited by Assistant Researcher XIANG Zhongjin, Prof. James WHITE of the University of Otago, New Zealand visited the Institute of Geology during April 28 to May 13, 2014. During his stay here, he gave two presentations entitled “General talk: Discuss a number of different volcanoes and types of volcanism” and “Explosive subaqueous volcanism”.

Fig.4.3.4. Prof. James White giving a presentation at the Institute.

Visit of Vladimir SHMELEV from the Institute of Geology and Geochemistry, Ural Branch of the Russian Academy of Sciences

Invited by Researcher MENG Fancong, Dr. Vladimir SHMELEV of the Institute of Geology and Geochemistry, Ural Branch of the Russian Academy of Sciences visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute of Geology, during May 8-18, 2014, for academic exchanges.

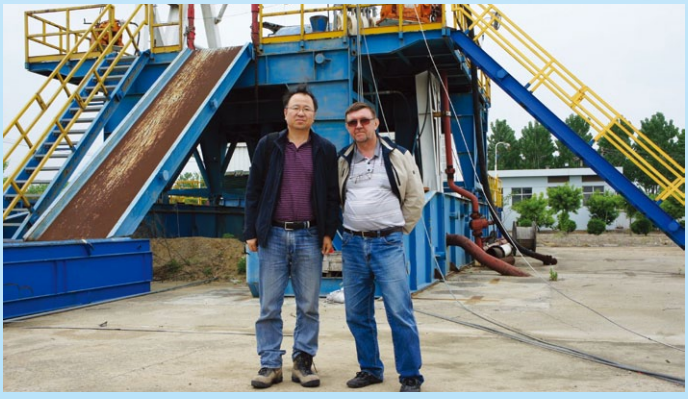


Fig.4.3.5 Researcher MENG Fancong and Dr. V. Shmelev at the China Continental Scientific Drilling site of Jiangsu Province.

Visit of Ariel ANBAR from Arizona State University, USA

Invited by Researcher ZHU Xiangkun, Prof. Ariel ANBAR of Arizona State University, USA, visited the Laboratory of Isotope Geology of the Institute of Geology, on June 20-23, 2014, for academic exchanges.

Fig.4.3.6 Prof. Ariel Anbar giving a presentation at the Institute.

Visit of Thomas JOHNSON from the University of Illinois at Urbana-Champaign, USA

Invited by Researcher ZHU Xiangkun, Prof. Thomas JOHNSON of the University of Illinois at Urbana-Champaign, USA, visited the Laboratory of Isotope Geology of the Institute of Geology, on July 15, 2014, for academic exchanges. He gave a presentation entitled “Environmental applications of heavy stable isotopes”.

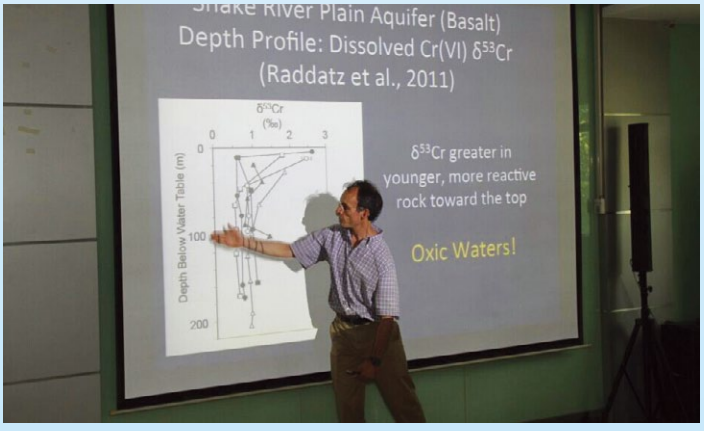


Fig.4.3.7 Prof. Thomas Johnson giving a presentation at the Institute.

Visit of Mark H. THIEMENS from the University of California, San Diego, USA

Invited by Researcher ZHU Xiangkun, Prof. Mark H. THIEMENS of the University of California, San Diego, USA, visited the Laboratory of Isotope Geology of the Institute of Geology on June 27, 2014, for academic exchanges. He gave a presentation entitled “Mass independent signatures in geochemistry: Tracking the origin of life and present global atmospheric-geochemical processes”.

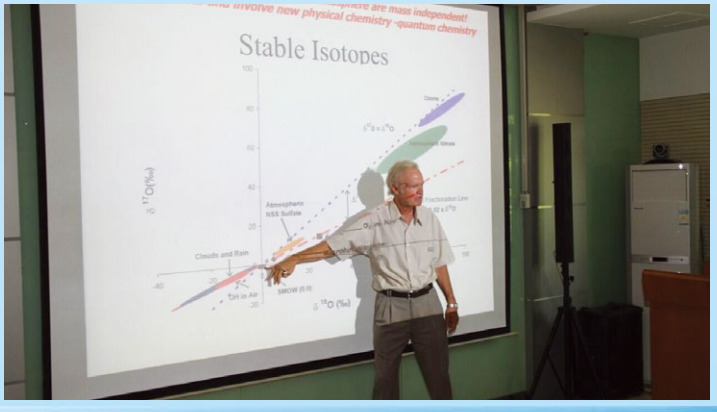


Fig.4.3.8. Prof. Mark H. Thiemens giving a presentation at the Institute.

Visit of Martin BRASIER from Oxford University and Simon POULTON from the University of Leeds, UK

Invited by Researcher ZHU Xiangkun, Prof. Martin BRASIER of Oxford University and Prof. Simon POULTON of the University of Leeds, UK, visited the Laboratory of Isotope Geology of the Institute of Geology on July 15-19, 2014, for academic exchanges. They also participated in a joint field trip to North China.

Fig.4.3.9 Prof. Martin Brasier visiting the Laboratory of Isotope Geology.

Visit of Alexander WEBB from Louisiana State University, USA

Invited by Academician XU Zhiqin, Prof. Alexander WEBB of Louisiana State University, USA visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute and worked on collaborative research during June 13 to July 3, 2014.

Fig.4.3.10 Prof. Alexander WEBB (left) at the field trip to Sichuan Province of China.

Visit of Isabelle Francoise COUTAND from Dalhousie University, Canada

Invited by Researcher LI Haibing, Prof. Isabelle Francoise COUTAND of Dalhousie University, Canada, visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute of Geology and delivered courses on thermochronology and geochronology during May 5-10, 2014.

Fig.4.3.11. Prof. Isabelle Francoise COUTAND delivering courses on thermochronology and geochronology.

Visit of Philippe Herve LELOUP and Gweltaz MAHEO of the Université Lyon 1, France

Invited by Researcher LI Haibing, Prof. Philippe Herve LELOUP and Prof. Gweltaz MAHEO of the Université Lyon 1, France, visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute of Geology and participated in a joint field trip to Sichuan Province during October 26 to November 24, 2014.

Fig.4.3.12. During the field trip to Sichuan Province of China.

Visit of Kazuo OIKE and Yoko OIKE of Kyoto University of Arts and Design, Japan

Invited by Researcher XU Jiren, Prof. Kazuo OIKE and Prof. Yoko OIKE of Kyoto University of Arts and Design, Japan visited the Institute of Geology and participated in a joint field trip to China Continental Scientific Drilling (CCSD) geophysical observation site in Jiangsu Province of China and to Guizhou Province during October 8-13, 2014.

Fig.4.3.13. During the field trip to Guizhou Province of China.

Visit of Martin KUNDRÁT from Uppsala University, Sweden

Invited by Researcher LV Junchang, Dr. Martin KUNDRÁT of Uppsala University, Sweden, visited the Institute of Geology and participated in a joint field trip to related basins of Liaoning and Henan Province of China during November 25 to December 11, 2014.

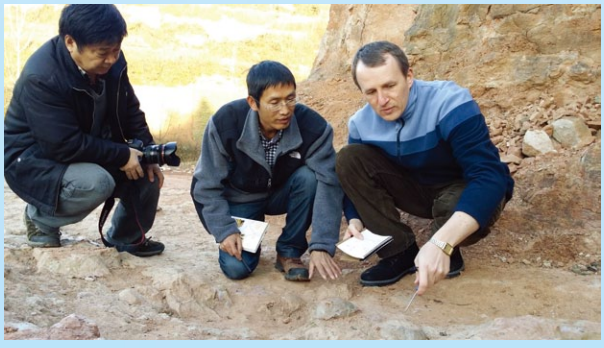


Fig.4.3.14. During the field trip to Zhengzhou of Henan Province.

Visit of Julian PEARCE from Cardiff University, UK

Invited by Researcher YANG Jingsui, Prof. Julian PEARCE of Cardiff University, UK, visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute and delivered a 2-day course on ophiolites on December 6-7, 2014. He also gave a presentation entitled "Fingerprinting of tectonic setting of ore deposits" on December 11, 2014.

Fig.4.3.15. Prof. Julian PEARCE giving a presentation at the Institute.

Visit of Yi1dirim DILEK from the University of Miami, USA

As the expert invited by the State Administration of Foreign Experts Affairs of China, Prof. Yi1dirim DILEK of the University of Miami, USA visited the State Key Laboratory of Continental Tectonics and Dynamics of the Institute three times in April, August and October of 2014. During his stay in the Institute, he helped to organize the International Workshop on Ophiolites, Mantle Processes and Related Ore Deposits; participated in joint field trips on ophiolites, and cooperated with Researcher YANG's team on several papers which were published in *Gondwana Research*, *Elements*, etc.

Fig.4.3.16. Prof. Yildirim DILEK addressing the International Workshop on Ophiolites, Mantle Processes and Related Ore Deposits.

Visit of Alfred KRÖNER and Yamirka ROJAS-AGRAMONTE from the University of Mainz, Germany

World famous geologist and Honorary Professor of the Beijing SHRIMP Centre and the Institute of Geology, Prof. Alfred KRÖNER, visited the Beijing SHRIMP Centre for collaborative research in March and April as well as September to October of 2014, respectively. Post-doctoral researcher Yamirka ROJAS-AGRAMONTE also visited the Beijing SHRIMP Centre in October 2014 where she dated ca. 0.2 Ma old zircons from the Galapagos Islands, Ecuador. During their visits, Prof. KRÖNER and Dr. ROJAS-AGRAMONTE also helped with the organization of IPRCC annual academic events.

Visit of Lutz NASDALA from University of Vienna, Austria

Internationally well-known mineralogist and crystallographer Prof. Lutz NASDALA from the University of Vienna, Austria, visited the Beijing SHRIMP Centre from April 14 to April 24 of 2014, for collaboration on the development of new zircon standards with scientists of the Center. During his stay, Prof. NASDALA also gave a two-day short course on "Radiation Damage in Zircon and Other Minerals" to CAGS students and young geologist. Over 20 people participated in the course.

Visit of Bor-ming JAHN from National Taiwan University

World famous geochemist, Knight of the French Ministry of National Education and Honorary Professor of the Beijing SHRIMP Centre and the Institute of Geology, Prof. Bor-ming JAHN visited the Beijing SHRIMP Centre for collaborative research in May and June of 2014. During his stay, Prof. JAHN also gave a collection of courses on "how to draft a scientific paper in English" to the young geologists of the Institute of Geology.

Visit of Steve CLEMENT from Canada

Dr. Steve CLEMENT, internaionally well-known Canadian specialist on ion optical design, visited the Beijing SHRIMP Centre twice in May and October respectively. The main purpose of his visit was to complete the annual work plan of the Specially-Funded Programme on National Key Scientific Instruments and Equipment Development – "new models of TOF-SIMS for Isotope Geology".

Fig.4.3.17. Dr. Steve CLEMENT giving a presentation on the progress of the development of TOF-SIMS.

Visit of Günther BRANDL from the Council for Geoscience, South Africa

Invited by Prof. WAN Yusheng and Dr. XIE Hangqiang of the Beijing SHRIMP Center of the Institute of Geology, Senior Scientist of the Council for Geoscience of South Africa, Dr. Günther BRANDL visited the Centre from September 22 to September 30 of 2014, to complete collaborative research on the Limpopo Belt, South Africa, with the Center's geologists. During his stay, Dr. BRANDL also gave a presentation entitled "The Limpopo Belt of southern Africa, and its relationship with the Kaapvaal Craton".

Other visits to the Beijing SHRIMP Center of the Institute of Geology

In 2014, more than 28 visitors from the Democratic Republic of Congo, Suriname, the UK and Canada visited the Center for laboratory tours and were deeply impressed by the facilities, technical team and scientific achievements of the Center.

Fig.4.3.18. Trainees from the Democratic Republic of Congo who participated in the 2014 Chinese Geological Survey Training course on Geology and Mineral Resources Exploration and Development visiting the Center.

Fig.4.3.19. Minister of Department of Natural Resources of the Republic of Suriname, Mr. Hok Jimmy KENNETH and colleagues visiting the Center.

Fig.4.3.20. Prof. GILMORE, Chairman of International Conference on Secondary Ion Mass Spectrometry (SIMS), visiting the Center.

Fig.4.3.21 The Canadian Delegation from the Saskatchewan Ministry of Economy and Geological Survey visiting the Center.

5. Important Academic Activities in 2014

5.1 International conferences and field excursions organized and held by the Institute

International Workshop on Ophiolites, Mantle Processes and Related Ore Deposits

The International Workshop on Ophiolites, Mantle Processes and Related Ore Deposits, jointly organized by the State Key Laboratory of Continental Tectonics and Dynamics of the Institute and the University of Hong Kong, was successfully held on April 14-15, 2014 in Beijing.

Academician XU Zhiqin, the Director of the State Key Laboratory of Continental Tectonics and Dynamics, presided over the opening ceremony. More than 20 internationally well-known experts and scholars, such as Prof. Yildirim DILEK, Vice President of the International Union of Geological Sciences (IUGS), delivered presentations at the workshop. More than 150 delegates from more than ten countries such as USA, UK, Australia, Egypt, Canada, Germany, Japan, etc. attended the workshop.

Fig 5.1.1 Academician XU Zhiqin hosting the Workshop.

Fig 5.1.2 Academician YANG Wencai hosting the Workshop.

Fig 5.1.3 Researcher YANG Jingsui giving an oral presentation.

Fig 5.1.4 Group photo of the attendees of the Workshop.

2014 Short Course of the International Precambrian Research Centre of China (IPRCC) on "Geochemical and Isotopic Approaches to Understanding Crustal Evolution"

The IPRCC Short Course 2014 on "Geochemical and Isotopic Approaches to Understanding Crustal Evolution" was held at CAGS in Beijing on September 13 and 14, 2014. Two world famous specialists on geochemistry and isotopes, Professor Kent CONDIE from the New Mexico Institute of Mining and Technology, Socorro, NM, USA, and Professor Jeff VERVOORT from Washington State University, Pullman, WA, USA, were invited as lecturers to introduce the behavior of elements and minerals during melting and crystallization, and the principles of Sm/Nd, Lu/Hf, Rb/Sr, Re/Os, U/Pb isotopic systems and their applications. Crustal evolution and distributions of elements in various tectonic environments were also discussed. More than 130 postgraduate students and young geologists from all over China participated in the course.

Fig 5.1.5 Prof. Alfred KRÖNER giving a lecture.

Fig 5.1.6 Prof. Kent CONDIE giving a lecture.

Fig 5.1.7 Prof. Jeff VERVOORT giving a lecture.

IPRCC 2014 Field Workshop

The IPRCC 2014 Field Workshop was held in the western Shandong area from September 15 to 19, 2014. More than 20 geologists and postgraduates from the USA, Germany, Australia and the Center participated in the Workshop. The trip examined outcrops of the early Neoarchean Yanlingguan-Liuhang assemblage and the late Neoarchean Shancaoyu-Jining assemblage on the road from Qi-xing-tai, Jinan to Tai-an; 2.7 Ga supracrustal rocks, 2.6 Ga intrusive rocks and 2.5 Ga intrusive rocks in the Tai-shan area and late Neoarchean magmatic rocks in the southwest Shandong area were visited.

Fig 5.1.8 International Field Excursion in West Shandong.

International Meeting on Regional Geology of Southeast Asia and East Tethys

The International Meeting on Regional Geology of Southeast Asia and East Tethys, organized by CGMW Subcommission for South and East Asia and hosted by the Institute of Geology, was held successfully on October 13-17, 2014 in Beijing.

Academician REN Jishun, Vice President of CGMW, presided over the meeting. Dr. Manuel PUBELLIER (Secretary General of CGMW), Prof. TRAN Van Tri (Vice President of Vietnam Union of Geological Sciences), Prof. Mario Juan AURELIO of the University of the Philippines, and Dr. Rolando PEÑA from the Stratigraphic Committee of Geological Society of the Philippines did reports on the geology and tectonics of MaritimeSoutheast Asia, Indo-China and the Philippines respectively, and Chinese scholars Drs. XING Guangfu, JI Wenhua, JIN Xiaochi etc. introduced good progress in geological surveys in Southeast China, the Qinghai-Tibet Plateau and West Yunnan. In addition, Dr. Igor POSPELOV from the Geological Institute of the Russian Academy of Sciences gave a presentation on Tectonics of Northern, Central and Eastern Asia at the meeting.

Fig 5.1.9 Academician REN Jishun hosting the meeting.

Fig 5.1.10 Discussion during the meeting.

5.2 Other Academic Activities

The 2013 Academic Workshop of the Institute of Geology was held on January 24, 2014

In order to exchange and discuss the scientific and technological achievements obtained in 2013, the Institute of Geology held the 2013 Academic Workshop from January 15-17, 2014. Twenty experts recommended by different divisions (centers) of the Institute gave academic presentations. The leaders of the Institute, some of the researchers and postgraduate students attended the workshop.

In addition, the workshop was also in memory of the 110th birthday of the famous Chinese structural geologists , Prof. HUANG Jiqing and Prof. LI Chunyu. Through the academic exchanges, the meeting memorized the great achievements of our predecessors and carried forward their scientific spirits.

Subsequently, some divisions (centers) organized special sessions for further discussion. The Annual Workshop was a great success and facilitated exchange and discussion of ideas and promoted the research capabilities of the Institute.

Fig 5.2.1 Dr. HOU Zengqian (first from right) hosting the Workshop.

Fig 5.2.2 Researchers and students listening to a presentation.

State Key Laboratory of Continental Tectonics and Dynamics successfully passed the assessment

The State Key Laboratory of Continental Tectonics and Dynamics has smoothly passed an assessment by experts, organized by the Ministry of Science and Technology on April 8-9, 2014. The assessment was a milestone for the construction and development of the laboratory, which marked the completion of construction and the successful ascent to the full status of a State Key Laboratory.

The State Key Laboratory of Continental Tectonics and Dynamics was recognized by the Ministry of Science and Technology in 2011 with an initial term of two years from October 13 of the same year. During the two years' construction period, remarkable progress was made in lab construction, talent introduction and office equipment with support from China Geological Survey and the Ministry of Land and Resources of China.

Fig 5.2.3 Academician XU Zhiqin reporting to the assessment team.

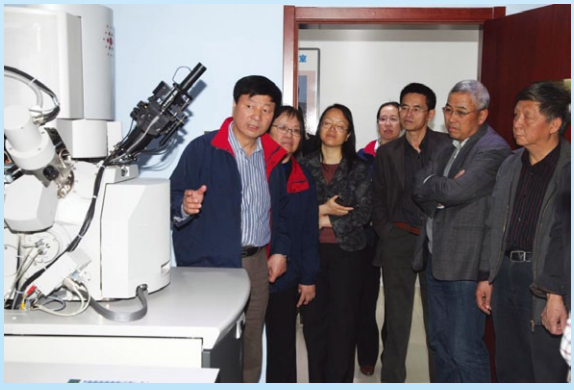


Fig 5.2.4 Researcher YANG Jingsui introducing the facilities of the laboratory.

First domestic Internet Platform of Geological Outcomes and Data was established in the Institute of Geology

In order to disseminate the scientific and technological achievements, promote academic and social exchanges, and develop the social service function of multidisciplinary scientific research institution, the Institute of Geology established an internet platform for geological outcomes and data, named "Information platform for geological

outcomes and data of the Institute of Geology (provisional name)" (domain name: "www.igeodata.org" and "www.igeodata.cn").

The establishment of this platform for geological outcomes and data is another step towards internationalization after publishing the Annual Report in English since 2010, and is a significant step to promote the Institute of Geology into a top-ranking modern research institute in the big data and information era.

Senior Research Fellow LIU Dunyi was named as a "Thomson Reuters Highly Cited Researchers of 2014"

In view of his landmark contributions to research in the field of geosciences, Senior Research Fellow Liu Dunyi was named a Thomson Reuters Highly Cited Researcher, and was invited to attend the 2014 China Citation Laureates Award Ceremony which was hosted by Thomson Reuters in Shangri-La Hotel, Beijing on October 27. 111 scientists from mainland China were selected as Highly Cited Researchers, and only 8 were from the geosciences. Liu Dunyi is the only scientist from the Ministry of Land and Resources who won the award.

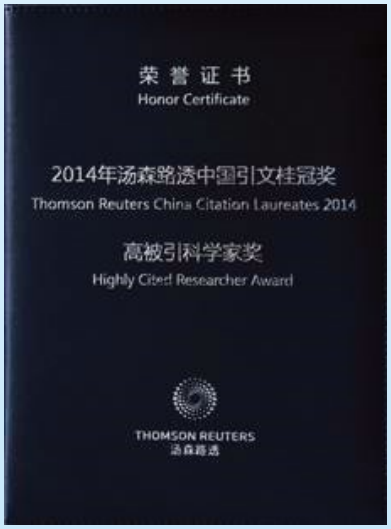


Fig. 5.2.5 the Honor Certificate-1

Fig. 5.2.6 the Honor Certificate-2

Senior Research Fellow, ZENG Lingsen was chosen as Grantee of the National Natural Science Foundation of China for Distinguished Young Scholars

The evaluation of the National Natural Science Foundation of China for Distinguished Young Scholars of 2014 has officially unveiled that Senior Research Fellow ZENG Lingsen from the State Key Laboratory of Continental Tectonics and Dynamics, Institute of Geology, was chosen as one of the grantees and won a grant of 4 million Yuan in recognition of his outstanding research on "Crustal anatexis and deep process in orogenic belts". He is the first grantee of the National Natural Science Foundation of China for Distinguished Young Scholars from the Ministry of Land and Resources during the past seven years.

Fig. 5.2.7 Researcher ZENG Lingsen.

6. Postgraduate Education

6.1 Postgraduate advisors

There were 94 postgraduate students in the Institute in 2014, including 44 doctoral and 50 master degree candidates. The Institute had 18 new candidates for the doctoral degree and 20 for the master degree. Detailed information on the 32 professorial advisors of doctoral students and 34 advisors of master students is listed below.

Advisors of doctoral students			
No.	**Name**	**Speciality**	**E-mail address**
1	SHEN Qihan	Early Precambrian geology and metamorphic methodology	huixiasong@cags.ac.cn
2	XIAO Xuchang	Tectonic geology, ophiolites, and HP metamorphic belts	xxchng@public.bta.net.cn
3	XU Zhiqin	Micro- and macrotectonics, geodynamics	xzq@ccsd.cn
4	REN Jishun	Geotonics and global tectonics	renjishun@cags.ac.cn
5	YANG Wencai	Geophysics	yangwencai@ccsd.org.cn
6	LI Tingdong	Regional geology	litdong@163.com
7	HOU Zengqian	Regional metallogeny	houzengqian@126.com
8	LIU Dunyi	Isotope geochronology and isotope geochemistry	liudunyi@bjshrimp.cn
9	YANG Jingsui	Petrology	yangjingsui@yahoo.com.cn
10	GAO Rui	Deep geophysical probing, lithospheric structure, and geodynamics	gaorui@cags.ac.cn
11	YAO Jianxin	Conodont fauna, stratigraphy	yaojianxin@gmail.com
12	WANG Tao	Tectonics and magmatic geology	taowang@cags.net.cn
13	LI Jinyi	Tectonics	jyli2003@126.com
14	CHEN Wen	Isotope geochronology	chenwenf@vip.sina.com
15	ZHU Xiangkun	Isotope geochronology	xkzhu0824@gmail.com
16	WU Cailai	Regional igneous petrology, agrogeology	wucailai@126.com
17	WAN Yusheng	SHRIMP geochronology, isotope geochemistry, and early Precambrian geology	wanyusheng@bjshrimp.cn
18	JIN Xiaochi	Biostratigraphy, sedimentology and paleogeography	jinxchi@cags.ac.cn
19	LIU Fulai	UHP metamorphic belts, isotope geochronology,	lfl0225@sina.com
20	ZHANG Jianxin	Metamorphsm and orogenic deformation	zjx66@yeah.net
21	ZHANG Zeming	Paleontology and metamorphic geology	zzm2111@sina.com
22	LI Haibing	Active tectonics and tectonic geomophology	lihaibing06@yahoo.com.cn
23	ZENG Lingsen	Petrology, geochemistry and tectonics	changting1970@yahoo.com
24	JIAN Ping	Isotope geochronology	jianping_510@aliyun.com
25	YAN Zhen	Structural geology	yanzhen@mail.iggcas.ac.cn
26	LIU Pengju	Paleontology and stratigraphy	pengju@cags.ac.cn
27	YANG Tiannan	Tectonics	yangtn@cags.ac.cn
28	MENG Fancong	Igneous petrology	mengfancong@yeah.net
29	LV Junchang	Mesozoic reptiles (dinosaurs, pterosaurs) and biostratigraphy	Lujc2008@126.com
30	LI Qiusheng	Geodetection and Information Technology	liqiusheng@cags.ac.cn
31	QI Xuexiang	Geotectonics	qxuex2005@163.com
32	XUE Huaimin	Mineralogy, petrology, and gitology	huaiminx@sina.com

Advisors of Master students			
No.	**Name**	**Speciality**	**E-mail address**
1	QIU Xiaoping	Petrology	qiuxping@cags.ac.cn
2	SONG Biao	SHRIMP geochronology	songbiao@cags.ac.cn
3	DING Xiaozhong	Regional geological mapping and GIS application	Xiaozhongding@sina.com
4	LIU Yan	Petrology	yanliu0315@yahoo.com.cn
5	LIU Yongqing	Sedimentology	liuyongqing@cags.ac.cn
6	JI Shu'an	Mesozoic reptiles (including birds) and biostratigraphy	jishu_an@sina.com
8	ZHOU Xiwen	Metamorphic geology	xwzhou@cags.ac.cn
9	REN Liudong	Metamorphism and Antarctic geology	ldren@cags.ac.cn
10	WANG Yong	Quaternary geology	wangyong@cags.ac.cn
11	WANG Yanbin	Isotopic dating, geological structures	wangyanbin@bjshrimp.cn
14	YANG Chonghui	Metamorphic geology	chhyang@cags.ac.cn
15	ZHANG Jin	Tectonics	zhangjinem@sina.com
16	JI Zhansheng	Paleontology and stratigraphy	jizhansheng@vip.sina.com
17	HE Rizheng	Geophysics	herizheng@cags.ac.cn
18	SHI Yuruo	Isotope geochronology	shiyuruo@bjshrimp.cn
19	YU Changqing	Geophysical Prospecting and Information Technology	yucq@tom.com
20	YANG Zhiming	Petrology	zm.yang@hotmail.com
21	LIU Jianhui	Tectonics	liujianhui1999@163.com
22	ZHAI Qingguo	Tectonics	zhaiqingguo@126.com
23	HE Bizhu	Mineral resources investigation and exploration	hebizhu@vip.sina.com
24	YOU Guoqing	Petrology	youchina@126.com
25	TANG Feng	Paleontology and stratigraphy	tangfeng@cags.ac.cn
26	TONG Ying	Petrology	yingtong@pku.org.cn
27	HE Zhenyu	Petrology	ahhzy@163.com
28	DONG Chunyan	Isotope geochronology	dongchunyan@sina.com
29	LIU Dongliang	Tectonics	pillar131@163.com
30	LU Zhanwu	Geophysics	luzhanwu78@163.com
31	XIE Hangqiang	Isotope geochronology	rock@bjshrimp.cn
32	Marie-Luce CHEVALIER	Tectonics	mlchevalier@hotmail.com
33	LIU Jianfeng	Isotope geochronology	wenjv@aliyun.com
34	YU Shegnyao	Tectonics	yushengyao1981@163.com
35	CAO Hui	Tectonics	caohuicugb@hotmail.com
36	LI Zhonghai	Tectonics	li.zhonghai@outlook.com
37	MENG En	Petrology	mengen0416@126.com
38	LIU Yan	Petrology	ly@cugb.edu.cn
39	ZHANG Cong	Petrology	congzhang@pku.edu.cn

6.2 Educational Activities and News

Eighteen graduate students were awarded diplomas at the 2014 Graduation Ceremony

Eight doctoral and ten postgraduate students completed their studies and obtained their degrees. GAO Li'e and ZHANG Yiping won the CHENG Yuqi Excellent Graduate Award; CAI Jia, LIU Chunhua and ZHANG Feifei received the CHENG Yuqi Excellent Thesis Award; SHI Zhigang was awarded the academic "Outstanding Graduate" honor, and seven additional graduate students received the academic "excellent student" honorary title. ZHAO Yuhao was awarded "excellent graduate student" by the Beijing Education Department.

LI Qiusheng, QI Xuexiang and XUE Huaimin were promoted to advisers of doctoral candidate students, YOU Guoqing, TANG Feng, TONG Ying, HE Zhenyu, DONG Chunyan, LIU Dongliang, LU Zhanwu, XIE Hangqiang, Marie-Luce CHEVALIER, LIU Jianfeng, YU Shegnyao, CAO Hui, LI Zhonghai, MENG En, LIU Yan, ZHANG Cong were approved to be advisors of Master students by the Degree Assessing Committee of CAGS.

Fig. 6.2.1 Graduation Ceremony of the 2014 postgraduate students.

7. Publications

7.1 English language publications:

Bao Peisheng, Su Li, Wang Jun, Zhai Qingguo. 2014. Origin of the Zedang and Luobusa Ophiolites, Tibet. Acta Geologica Sinica (English Edition), 88: 669-698.

Cai Jia, Liu Fulai, Liu Pinghua, Liu Chaohui, Wang Fang, Shi Jianrong. 2014. Metamorphic P-T path and tectonic implications of pelitic granulites from the Daqingshan Complex of the Khondalite Belt, North China Craton. Precambrian Research, 241: 161-184.

Cao Hui, Xu Cuiping. 2014. Survival conditions of folding in different depth during orogenesis. Acta Geologica Sinica (English Edition), 88(1): 103–112.

Chen Liemeng, Song Xieyan, Zhu Xiangkun, Zhang Xiaoqi, Yu Songyue, Yi Junnian. 2014. Iron isotope fractionation during crystallization and sub-solidus re-equilibration: Constraints from the Baima mafic layered intrusion, SW China. Chemical Geology, 380: 97-109.

Chen Xijie, Shu Liangshu, M.Santosh, Xu Zhiqin. 2014. The provenance and tectonic affinity of the Paleozoic meta-sedimentary rocks in the Chinese Tianshan belt: New insights from detrital zircon U–Pb geochronology and Hf–isotope analysis. Journal of Asian Earth Sciences, 94:12-27.

Dong C.Y., Wan Y.S., Wilde, S.A., Xu Z.Y., Ma M.Z., Xie H.Q., Liu D.Y.. 2014. Earliest Paleoproterozoic supracrustal rocks in the North China Craton recognized from the Daqingshan area of the Khondalite Belt: Constraints on craton evolution. Gondwana Research, 25: 1535-1553.

Dong Hanwen, Xu Zhiqin, Li Yuan. 2014. Pressure-temperature evolution of the Metapelites in the Motuo area, the Eastern Himalayan Syntaxis. Acta Geologica Sinica (English Edition), 88(2): 544-557.

Du L.L., Guo J.H., Nutman, A.P., Wyman, D., Geng Y.S., Yang C.H., Liu F.L., Ren L.D., Zhou X.W. 2014. Implications for Rodinia reconstructions for the initiation of Neoproterozoic subduction at ~860Ma on the western margin of the Yangtze Block: Evidence from the Guandaoshan Pluton. Lithos, 196-197: 67-82.

Dong Hanwen, Xu Zhiqin, Li Yuan, Liu Zhao, Li Huaqi. 2014. The Mesozoic metamorphic–magmatic events in the Medog area, the eastern Himalayan syntaxis: constraints from zircon U–Pb geochronology, trace elements and Hf isotope compositions in granitoids. International Journal of Earth Sciences, doi: 10.1007/s00531-014-1057-y.

Feng Guangying, Liu Shen, Feng Caixia, Yang Yuhong, Yang Chaogui, Tang Liang, Yang Jingsui. 2014. U–Pb zircon geochronology, geochemistry and geodynamic significance of basaltic trachyandesites and trachyandesites from the Jianchang area, western Liaoning Province, China. Journal of Asian Earth Sciences, http://dx.doi.org/10.1016/j.jseaes.2014.07.025

Gao Li'e, Zeng Lingsen.2014. Miocene high-Ca two-mica granites in the Malashan gneiss dome, southern Tibet: fluxing melting during tectonic transition from compression to extension. Geochemica et Cosmochimica Acta, 130: 136-155.

Gao Rui, Wang Haiyan, Zeng Lingsen, Zhang Jisheng, Guo Tonglou, Li Qiusheng, Li Pengwu, Lu Zhanwu, Guan Ye. 2014. The curst structures and the connection of the Songpan block and West Qinling orogen revealed by the Hezuo-Tangke deep seismic reflection profiling. Tectonophysics, 634: 227-236.

Guo Xiaoyu, Keller, G.Randy, Gao Rui, Xu Xiao, Wang Haiyan, Li Wenhui. 2014. Irregular western margin of the Yangtze block as a cause of variation in tectonic activity along the Longmen Shan fault zone, eastern Tibet. International Geology Review, 56(4): 473-480.

Gong Zheng, Li Haibing, Lao Changling, Tang Lijun, Luo Liqiang. 2014. Real-time drilling mud gas monitoring records seismic damage zone from the 2008 Mw 7.9 Wenchuan earthquake. Tectonophysics, http://dx.doi.org/10.1016/j.tecto.2014.11.017.

He Bizhu, Qiao Xiufu, Jiao Cunli, Xu Zhiqin, Cai Zhihui, Guo Xianpu, Zhang Yinli. 2014. Palaeo-earthquake events during the late Early Palaeozoic in the central Tarim Basin (NW China): evidence from deep drilling cores. Geologos, 20(2): 105–123.

He Bizhu, Qiao Xiufu, Zhang Yingli, Tian Hongshui, Cai Zhihui, Chen Shuqing, Zhang Yanxia. 2014. Soft-sediment deformation structures in the Cretaceous Zhucheng depression, Shandong Province, east China; their character, deformation timing and tectonic implications. Journal of Asian Earth Sciences, doi:10.1016/j.jseaes.2014.12.005.

Huang B.T., He Z.Y, Zhang Z.M., Klemd, R., Zong K.Q., Zhao Z.D.. 2014. Early Neoproterozoic granitic gneisses in the Chinese Eastern Tianshan: Petrogenesis and tectonic implications. Journal of Asian Earth Sciences, http://dx.doi.org/10.1016/j.jseaes.2014.08.021.

Huang Hao, Shi Yunkun, Jin Xiaochi. 2014. Permian fusulinid biostratigraphy of the Baoshan Block in western Yunnan, China with constraints on paleogeography and paleoclimate. Journal of Asian Earth Sciences,doi:10.1016/j.jseaes.2014.10.010.

He Rizheng, Liu Guocheng, Eva Golos, Gao Rui, Zheng Hongwei. 2014. Isostatic gravity anomaly, lithospheric scale density structure of the northern Tibetan plateau and geodynamic causes for potassic lava eruption in Neogene. Tectonophysics,618: 218-227.

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