of karst water. ③ Long-term cave monitoring result indicates the cave air temperature decreased and the karst process increased as the vegetation restoration. ④ The systematic atmospheric precipitation—cave drip water—modern calcite monitoring and recently deposited stalagmites research support the stalagmite $\delta^{18}O$ in this area can reflect the rainfall variation in decadal scale. ⑤ The first and second terraces of Lijiang River and the peat in Lijiang River Basin were formed in middle Holocene and MIS3, respectively, human appeared in this area since MIS3, and emigrated out of the cave since the middle Holocene.

All these evidences indicate higher precipitation in these two periods for the stronger summer monsoon. The summer monsoon and precipitation gradually decreased since the middle Holocene.

Keywords: climatic change; environmental evolution; human evolution; last glacial; Lijiang River Basin

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《地质论评》前编委、中国震积岩研究的开拓者乔秀夫研究员逝世

《地质论评》前编委、中国震积岩研究的开拓者乔秀夫研究员不幸于2021年3月1日因病逝世,享年91岁。3月4日上午著名沉积学家冯增昭教授及地质学界数十人在北京八宝山送别了乔秀夫先生。

乔秀夫先生,1930年10月30日出生于山西省交城县義望村,其父为毕业于黄埔六期的抗日名将,1948年12月参加革命工作,中国共产党党员。1950年9月~1952年9月,在北京大学地质系学习,后转北京地质学院,1953年于北京地质学院毕业并留校任教。1969年~1973年江西、湖北"五七"干校劳动锻炼,1973年~1978年在武汉地质学院任教。1978年以来,一直在中国地质科学院地质研究所工作,历任区域地质与编图研究室副主任、主任。1991年开始享受首批国务院颁发的政府特殊津贴,1995年11月离休。

乔秀夫先生长期从事区域地质综合研究与地质编图、沉积学与岩相古地理、前寒武纪构造古地理、地层学与软沉积物变形(灾变地层、震积岩)等方面研究,是我国著名的地质学家,是我国老一辈地质工作者的杰出代表之一。主持或参与了10多项国家和部级科技攻关项目、重点项目和地质调查项目,以及中国石化科技攻关项目,发表论文100余篇,出版专著(文集)6部,其研究成果获国家自然科学二等奖1项,地质矿产部(国土资源部)科学技术奖一等奖4项、二等奖1项。1980年开始,作为主要成员,协助王鸿祯院士主编完成了《中国古地理图集》,编制了1:900万《华北中元古代(长城期1.85~1.7 Ga)古地理图》、1:900万《华北中元古代(南口期1.7~1.4 Ga)古地理图》、1:900万《华北中元古代(蓟县期1.4~1.0 Ga)古地理图》、1:900万《华北晚元古代(青白口期1.0~0.85 Ga)古地理图》、1:1800万《中国中、晚元古代古构造图》等;1996年,共同主持编制出版了《中国地质图集》(中、英文版),以及1:350万《华北地区地质图》等一系列大型地质图集和小比例尺地质图件,其成果在国际、国内得到广泛应用,受到极高的评价,为我国地质事业的发展作出了重要贡献。

乔秀夫先生60多岁至近80岁仍经常到野外一线进行地质研究,80多岁仍笔耕不止;作为负责人或顾问完成了多个地质科研项目[如"胶辽徐淮地区新元古代对比"(1996~1998,负责人)、"华北地台南缘晚前寒武纪综合地层学研究"(1999~2000,负责人)"中国层序地、地球演化节律与古大陆再造研究"(1997~2001,国家攀登项目,二级课题负责人)、"华北块体周边新元古代地层及构造格架研究"(2000~2002,项目顾问)、"中国大陆及边缘关键地史阶段地震事件地层研究"(2003~2005,项目顾问)、"华北块体东南缘新元古代地层界定与地层对比"(2006~2008,项目顾问)、"中国新元古代的下马岭组底界年代学研究"(2008~2009,项目顾问)、"中国中新元古代地层年代学标定"(2009~2010,项目顾问)],继续发表了大量学术文章。

乔秀夫先生早年对华北地台元古代地层及吕梁运动、芹峪运动等进行了深入研究,1953年起带领北京地质学院学生在北京西山、河北唐山等地野外教学实习,同时开展了前寒武纪研究,提出了有关地层关系、构造运动和岩浆活动的新认识,对华北地台形成演化和

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bands, which was consistent with the high U content of the zircons ($1253.1\times10^{-6}\sim12861.5\times10^{-6}$, $874.5\times10^{-6}\sim5319.1\times10^{-6}$). Zircon has since the shape characteristic of the magmatic zircon, but Th/U ratios (0.01 ~ 0.26, and 0.01 ~ 0.62) is low, show the characteristics of hydrothermal zircon, rare earth distribution patterns in $(Sm/La)_N$—La and Ce/Ce^*—$(Sm/La)_N$ illustration on partial hydrothermal zircon area, the giant crystal granite dyke is likely to be female height of magma crystallization differentiation after the residual magma hydrothermal crystallization, partial hydrothermal properties. The two samples (DST-TW1 and WJG-TW1) studied in this paper were 1864±20 Ma (MSWD=0.19) and 1903.6± 4.7 Ma (MSWD=0.041), the emplacement time ranged from 1.9 Ga to 1.86 Ga. It is inferred from the rock geochemistry and the formation age that the provenance is related to the S-type granite ~ 1.87 Ga around the study area. On tectonic environment, the Paleoproterozoic granitic pegmatite in the study area was formed under the extensional tectonic system after the arc—continental collision of the Jiao—Liao—Ji Paleoproterozoic orogenic belt; after the main period of granitic magma upwelling, the crust is constantly stretching and relaxation collapse, a large number of residual magma or magmatic hydrothermal upwelled, which leads to form pegmatite dykes or intrusives; the emplacement ages are from ~1.9 Ga to ~1.74 Ga. Therefore, it can be inferred that the Jiao—Liao—Ji orogenic belt has been in the extensional tectonic mechanism during the post-collision reentry process, and the post-orogenic stage lasted at least 160 Ma.

Keywords: Paleoproterozoic granitic pegmatites; LA-ICP-MS zircon U-Pb age; petrogeochemistry; Xiuyan area of the eastern Liaoning Province

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(上接第 503 页) 地质找矿工作具有重要意义。

乔秀夫先生自 20 世纪 90 年代开始,率先在中国开展了软沉积物变形及古地震研究,并取得了优异成绩,是我国当之无愧的震积岩研究的开拓者、古地震研究先驱及领航人。作为研究项目群体学术带头人,乔先生近 20 余年来力排各种微言和众议,坚持学科交叉和科技创新,积极推进古地震触发软沉积物变形构造成因机制研究,提出地震触发软沉积物变形分类,为中国古地震研究的学科建立和发展提供了理论和实践平台。研究范围涉及华北板块燕山裂陷槽古元古界—中元古界、塔里木盆地中央隆起古生代地层、四川龙门山山前地带中—新生界等不同时代的古地震记录,以一种全新的思维解释区域地球动力作用与沉积—构造演化历史。研究内容涉猎元古宙至第四纪沉积物变形特征、结构构造、成因序列、层序格架和古构造格局等,取得了该领域世界一流的研究成果,为能源矿产资源的调查研究与勘探开发提供了重要依据。

乔秀夫先生一生爱国敬业、无私奉献,从塔里木盆地到辽东半岛,从川西龙门山到山东半岛都留下了他孜孜以求、不断探索的足迹;他为人正直、诲人不倦,赢得了同行、特别是年轻人的尊敬和爱戴。1988 年~1990 年,乔先生带领中国地质科学院地质研究所十几名年轻人对北京西山下苇甸—担礼寒武系—奥陶系剖面进行野外现场讲解,并指导完成了系列研究论文(发表在中国地质科学院地质研究所所刊);1990 年代中期,带领多位年轻学者对北京西山及华北地台其他地区元古宙—古生代地层开展了露头层序地层学研究。乔先生对后辈的提携总是倾囊相授。

乔秀夫先生的逝世,使我们失去了一位良师益友。

乔秀夫先生:一生光明磊落对人对世清白无瑕,终身求知好学务真务实心底无私。

乔秀夫先生千古!

(丁孝忠、高林志 供稿 章雨旭 编辑)

Prof. QIAO Xiufu, former editorial committee member of *Geological Review* and pioneer of seismite study in China, pass away