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安徽省铜陵矿集区狮子山岩浆流体系统地球化学测试数据集

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摘要：铜陵矿集区是中国最著名的铜、金、铁产地之一，该矿集区内成矿与岩浆作用关系密切。狮子山岩浆流体系统分布最为广泛，是铜陵矿集区岩浆活动与成矿作用的主体，为众多地质学家所重视。狮子山岩浆流体系统地球化学测试数据集包括系统内具有代表性的34件岩石样品主微量元素数据、32件流体包裹体显微测温数据；5件石英包裹体稀土、微量元素数据；28件样品C−H−O同位素数据及27件样品的硫同位素测试数据。全部测试均在国家知名测试数据实验室进行，数据质量可靠。该数据集可以反映狮子山岩浆子系统的岩浆活动特征、成矿流体特征、成矿物质来源，为揭示矿床成因、成矿流体来源及演化等科学问题提供数据支撑。

关键词：铜陵矿集区；岩浆流体系统；狮子山；地球化学测试数据集

数据服务系统网址：http://dcc.cgs.gov.cn

1　引言

1.1　区域地质背景

狮子山成矿流体系统发育于中晚侏罗世，主要分布于铜官山矿田、狮子山矿田(及其南部的焦冲、严冲一带)、凤凰山矿田和沙滩脚矿田等地。产出部位主要集中在岩体与围岩的接触带，少量为层间交代和渗滤矽卡岩，在铜官山矿田和狮子山矿田矽卡岩矿化叠加于早期的块状硫化物矿层之上，形成独特的“多层楼”式矿床。新鲜岩体的全岩K/Ar年龄为(152.99 ± 2.85) Ma(凤凰山花岗闪长岩)~135.3 Ma(铜官山浅灰色石英二长闪长岩)(周泰禧等，1987)，有从东到西逐渐变新的趋势。矽卡岩型矿化围绕岩体呈环状和点状发育，在铜陵矿集区内成群成带分布，构成北东成列、东西成带的流体活动域。该期岩浆子系统以狮子山矿田最为发育，作用类型最全。狮子山岩浆子系统的活动对铜陵地区的成矿作用影响极大，不仅将先存的SEDEX型块状黄铁矿层叠加改造为大型层状铜矿床，如冬瓜山、松树山、老庙基山、天马山、新桥等；而且形成大量矽卡岩

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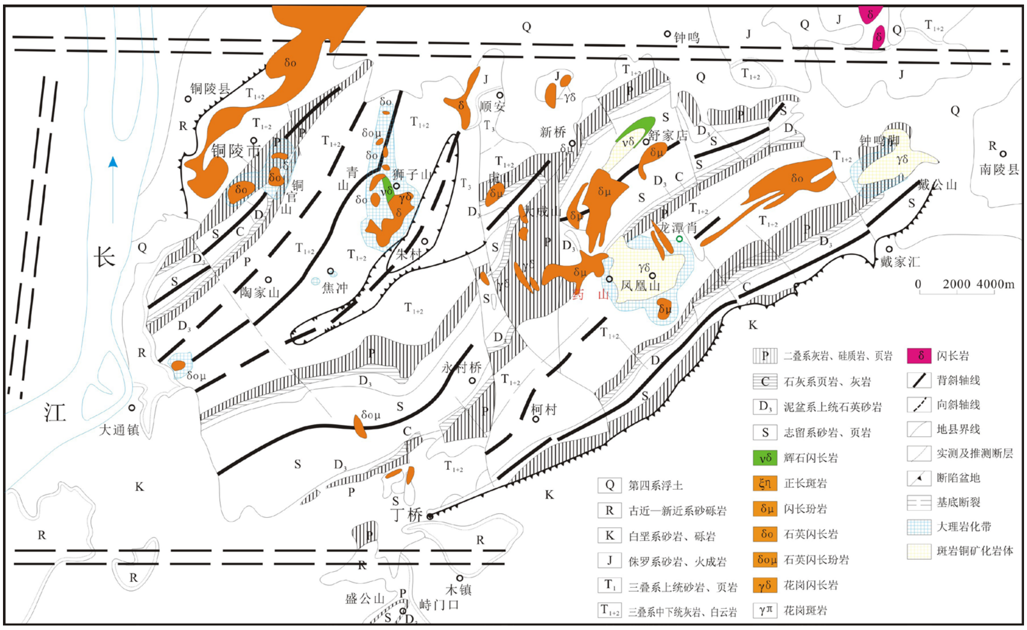

图 1　铜陵矿集区岩浆流体系统分布示意图（据 321 地质队）

型铜铁金矿床，如小铜官山、笔山、东西狮子山、大团山、老鸦岭、凤凰山、沙滩脚等地的铜矿床（图 1）。使本区成矿达到顶峰阶段（杨竹森等，2004）。矽卡岩型成矿与石英二长闪长岩和辉石二长闪长岩密切相关，以发育多种类型的矽卡岩为特征。分为三种类型：矽卡岩型，如西狮子山（区域上可与江西武山南矿带、湖北铜录山等对比）；隐爆角砾岩型，如东狮子山、药园山（区域上可与江西洋鸡山对比）；中低温热液脉型，如鸡冠石（可与定县小庙山对比）。成矿作用形成典型的矽卡岩型矿物组合：石榴子石＋透辉石＋磁铁矿带－黄铜矿＋黄铁矿＋磁黄铁矿＋（透闪石＋阳起石）带－石英＋方解石带，产出部位主要集中在岩体与围岩的接触带，少量为层间交代和渗滤矽卡岩。

1.2　数据意义

铜陵矿集区是中国最著名的铜、金、铁产地之一，该矿集区内成矿与岩浆作用关系密切（翟裕生，1992；Zhai et al, 1996；侯增谦等，2011；周涛发等，2012）。狮子山岩浆流体系统分布最为广泛，是铜陵矿集区岩浆活动与成矿作用的主体，为众多地质学家所重视（郭宗山，1957；郭文魁，1957；常印佛等，1983，1991；毛健仁等，1990；邓晋福等，1992；吴言昌，1992；唐永成等，1998；Xu et al., 2005，2007）。狮子山岩浆流体系统地球化学数据集包括成矿岩体主微量元素数据、流体包裹体主微量及显微测温数据和稳定同位素数据，可以反映狮子山岩浆子系统的岩浆活动特征、成矿流体特征、成矿物质来源，对揭示矿床成因、成矿流体及成矿物质来源具有重要参考价值。

1.3　数据集元数据简介

铜陵矿集区狮子山岩浆流体系统地球化学测试数据集的元数据简介见表 1。它包括数据集的名称、数据论文作者、通讯作者、数据采集时间、地理区域、数据量、数据格式、数据出版地址、基金项目、数据库（集）组成等。

表 1 数据库（集）元数据简表

条目	描述
数据库（集）名称	安徽省铜陵矿集区狮子山岩浆流体系统地球化学测试数据集
数据采集时间	2001—2005 年
地理区域	安徽省铜陵地区
数据量	98 kB
数据格式	.xlsx
数据服务系统网址	http://dcc.cgs.gov.cn
基金项目	国土资源部大型综合性科技专项研究（20010103）
数据库（集）组成	数据集由 3 个部分，共计 7 个数据表组成： 第一部分为狮子山岩浆流体系统岩浆岩全岩主微量元素分析结果，包括“表 1-1 狮子山岩浆系统成矿岩体主量元素数据表”、“表 1-2 狮子山岩浆子系统岩浆岩微量稀土元素数据表”；第二部分为狮子山岩浆流体系统流体包裹体显微测温、微量稀土及液相成分数据，包括“表 2-1 狮子山岩浆流体系统流体包裹体显微测温均一温度测定结果表”、“表 2-2 铜陵地区矿床石英包裹体的稀土元素特征表”；“表 2-3 铜陵地区矿床石英包裹体的微量元素特征表”；第三部分为狮子山岩浆流体系统 C-H-O-S 稳定同位素数据，包括“表 3-1 狮子山岩浆子系统碳、氧、氢同位素测试结果”、“表 3-2 铜陵地区代表性矿床硫同位素测试结果”。

2 数据采集和处理方法

2.1 样品采集

狮子山岩浆流体系统成矿岩体样品来自于狮子山岩浆流体系统中新桥、凤凰山、东狮子山、铜官山等代表性矿床的新鲜石英二长岩、石英闪长岩、花岗闪长岩及矽卡岩化、钾化硅化弱蚀变岩浆岩样品。

流体包裹体采样及测试：测试的样品采自铜陵矿集区几个主要的岩浆岩有关的矿区，包括铜官山、朝山、冬瓜山、凤凰山的风相埂陈等地，选取与岩浆活动有关的石英和方解石磨制包裹体片。

黄铁矿、黄铜矿和胶黄铁矿硫同位素样品来自于狮子山岩浆流体系统的代表性矿床新桥、凤凰山、东狮子山、铜官山和鸡冠石岩浆岩、矽卡岩和铜铁矿石。

大理岩、矽卡岩和方解石的碳、氢、氧同位素样品来自于狮子山岩浆流体系统的代表性矿床。

2.2 测试方法

本次研究工作对铜陵矿集区狮子山岩浆流体系统中与成矿密切的岩体岩浆岩样品进行了地球化学测试和分析，其中包括 34 件岩浆岩的全岩主量元素及 18 件岩浆岩样品的稀土元素和微量元素测试项。上述样品的测试工作在中国地质科学院地球物理地球化学研究所实验室完成，其中全岩主量元素分析测试采用的 X- 射线荧光光谱法 (XRF)；微量元素测定采用 ICPMS 法。

流体包裹体显微测温用 Linkam 公司的 THMS600 冷热台测试，测试工作在北京科技大学完成。实验仪器技术参数为：铂电阻传感器，控制稳定温度 ±0.01 ℃，最低为 0.01 ℃显示温度，为 −196~600 ℃测温范围，16 mm 样品轴向移动距离，1.3 mm 光孔直径，0.01~130 ℃ /min 加热 / 冷冻速率。KNO_3、CCl_4、K_2CrO_3 和人工配制的 NaCl 标准溶液为仪器标定采用标准物质，±2 ℃为在 400 ℃时相对于标准物质误差，±0.1 ℃为

在 −22 ℃时相对于标准物质误差。一般设置 10 ℃ /min 为在加热或冷冻过程中的控温速率，在相变点附近设置小于 1 ℃ /min 的速率。其放大倍数在结合 OLMPUS0BX51 型光学显微镜之后为 100~800 倍。包裹体测温实验过程为：利用液氮降温→冷冻中观察包裹体变化→缓慢升温，控制接近相变点时速率→观察记录三相点、冰点、笼形物消失温度等。

矿石矿物 S 同位素及大理岩、矽卡岩和方解石的 C−H−O 同位素分别由国土资源部同位素开放实验室和中国地质科学院同位素开放实验室测定，测试仪器为 MAT−253 质谱仪。氧同位素分析首先破碎采集的样品，过筛至 40~60 目，然后在双目镜下观察并挑选纯净单矿物，纯度应在 99% 以上。经清洗样品，并去样品的吸附水和次生包裹体后进行研究。氧同位素分析采用 BrF_5 法 (Clayton et al.，1963)，首先将纯净的样品选取 12 mg，并将其与 BrF_5 反应 15 h，萃取 O_2。并将萃取的 O_2 放入 CO_2 转化系统，并设置 700 ℃、12 min，制成并收集 CO_2。氢同位素分析采用真空爆裂法和锌还原法提取氢。首先加热至可爆裂包裹体样品的温度，并释放挥发分，提取水蒸气，然后使水与锌在 400 ℃条件下发生反应并产生氢气 (Coleman et al.，1982)，用液氮冷却，放入含有活性炭的瓶中。氢和氧同位素的分析结果均以 SMOW 为标准。氢同位素的分析精度为 ±2%，氧同位素的分析精度为 ±0.2%。C−O 同位素用 100% 磷酸法。$\delta^{13}C$ 的分析结果以 V−PDB 为标准，$\delta^{18}O$ 的分析结果分别以 V−PDB 和 SMOW 为标准，计算 $\delta^{18}O$ 时，采用 Coplen 等 (1983) 的公式：$\delta^{18}O_{SMOW}=1.03091\times\delta^{18}O_{PDB}+30.91$. 分析精度 $\delta^{13}C$ 好于 0.05‰，$\delta^{18}O$ 好于 0.10‰。

3 数据样本描述

铜陵矿集区狮子山岩浆子系统地球化学测试数据集为 Excel 表格型数据，包含三个部分 7 个 Excel 数据文件：第一部分为狮子山岩浆流体系统岩浆岩全岩主微量元素分析结果，包括“表 1−1 狮子山岩浆系统成矿岩体主量元素数据”、“表 1−2 狮子山岩浆流体系统岩浆岩微量稀土元素数据表”；第二部分为狮子山岩浆流体系统流体包裹体显微测温、微量稀土及液相成分数据，包括“表 2−1 狮子山岩浆流体系统流体包裹体显微测温均一温度测定结果表”、“表 2−2 铜陵地区矿床石英包裹体的稀土元素特征表”；“表 2−3 铜陵地区矿床石英包裹体的微量元素特征表”；第三部分为狮子山岩浆流体系统 C−H−O−S 稳定同位素数据，包括“表 3−1 狮子山岩浆子系统碳、氧、氢同位素测试结果”、“表 3−2 铜陵地区代表性矿床硫同位素测试结果”。其中“狮子山岩浆流体系统岩浆岩主微量元素分析结果数据表”数据文件，描述的是采自狮子山岩浆流体系统中与成矿密切岩体中的 34 件岩石样品采样位置及主量元素信息（表 2）；“狮子山岩浆子系统岩浆岩微量稀土元素数据表”描述的是狮子山岩浆流体系统中与成矿密切岩体中采集的 18 件岩石样品采样位置及微量元素和稀土元素信息（表 3）；“狮子山岩浆流体系统流体包裹体显微测温均一温度测定结果表”描述的是狮子山岩浆流体系统中与岩浆活动有关 32 件岩石样品中石英和方解石包裹体的均一温度信息（表 4）；“铜陵地区矿床石英包裹体的稀土元素特征表”和“铜陵地区矿床石英包裹体的微量元素特征表”描述的是铜陵地区 4 件矿床石英包裹体样品的微量稀土元素特征（表 5，表 6）；“狮子山岩浆子系统碳、氧、氢同位素测试结果”描述的是与狮子山岩浆子系统有关的热液系统中 28 件样品的碳、氢、氧同位素组成信息（表 7）；“铜陵地区代表性矿床硫同位素测试结 果”描述的是采自铜陵地区代表性矿床 27 件样品的硫同位素测试结果（表 8）。

表 2　狮子山岩浆子系统岩浆岩主量元素分析结果数据表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	L1-1-1
2	产地		字符型	新桥头
3	岩性		字符型	浅灰色粗斑花岗闪长斑岩
4	测试元素		字符型	SiO_2
5	元素含量	%	浮点型	58.96

表 3　狮子山岩浆子系统岩浆岩微量稀土元素分析结果数据表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	L1-1-1
2	产地		字符型	新桥头
3	岩性		字符型	浅灰色粗斑花岗闪长斑岩
3	测试元素		字符型	La
4	元素含量	10^{-6}	浮点型	26.6

表 4　狮子山岩浆流体系统流体包裹体显微测温均一温度测定结果表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	C43−8−2
2	采样位置		字符型	朝山
3	测定对象		字符型	石英
4	均一温度范围	℃	字符型	276.9~417.0
5	平均均一温度	℃	浮点型	363.9

表 5　铜陵地区矿床石英包裹体的稀土元素特征表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	TGS-4
2	采样位置		字符型	铜官山
3	测定对象		字符型	石英包裹体
4	测试元素		字符型	La
5	元素含量	10^{-9}	浮点型	0.11
6	H_2O	μL/g	浮点型	0.116

表 6　铜陵地区矿床石英包裹体的微量元素特征表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	TGS−4
2	采样位置		字符型	铜官山
3	测定对象		字符型	石英包裹体
4	测试元素		字符型	Li
5	元素含量（经中国陆壳元素丰度 (黎彤，1988) 标准化）		浮点型	0.972
6	特征元素参数		字符型	Co/Ni
7	特征元素含量比值		浮点型	0.18

表 7　狮子山岩浆子系统碳、氧、氢同位素测试结果表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	C120-19-10
2	岩石名称		字符型	含黄铁矿脉粗晶大理岩
3	采样地点		字符型	朝山
4	测试对象		字符型	方解石
6	$\delta^{18}O_{SMOW}$		浮点型	22.5
7	$\delta^{13}C_{PDB}$	‰	浮点型	3.6
8	$\delta^{18}O_{H2O}$	‰	浮点型	18.4
9	δD	‰	浮点型	-39

表 8　铜陵地区代表性矿床硫同位素测试结果表

序号	字段名称	量纲	数据类型	实例
1	样品号		字符型	III−1
2	产地		字符型	新桥
3	样品名称		字符型	含石英黄铁矿闪长玢岩
4	单矿物种类		字符型	浸染状黄铁矿
6	$\delta^{34}S_{VCDT}$	‰	浮点型	2.5

4　数据质量控制和评估

4.1　主量元素、微量元素测试

主量元素分析相对误差优于 5%；微量元素（含稀土元素）分析，当元素含量大于 10×10^{-6} 时，相对误差小于 5%，含量小于 10×10^{-6} 时，相对误差小于 10%。

4.2　流体包裹体显微测温数据

KNO_3、CCl_4、K_2CrO_3 和人工配制的 NaCl 标准溶液为仪器标定采用标准物质，±2 ℃为在 400 ℃时相对于标准物质误差，±0.1 ℃为在 −22 ℃时相对于标准物质误差。包裹体测定数从 10 至大于 20 不等。

4.3　稳定同位素测试

氢同位素的分析精度为 ±2%；氧同位素的分析精度为 ±0.2%；$\delta^{13}C$ 分析精度好于 0.05‰，$\delta^{18}O$ 分析精度好于 0.10‰。

5　结论

狮子山岩浆流体系统地球化学数据集为一套系统的数据集，包括狮子山岩浆流体系统内主要成矿岩体主微量元素数据、流体包裹体主微量及显微测温数据和稳定同位素数据。该数据集可以系统地反映狮子山岩浆子系统的岩浆活动特征、成矿流体特征、成矿物质来源，为揭示矿床成因、成矿流体及成矿物质来源及演化等科学问题提供数据支撑，具有重要参考价值。

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Geochemical Dataset of the Shizishan Magmatic Fluid System in the Tongling Ore Concentration Area, Anhui Province

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Abstract: Tongling ore district is one of the most well-known Cu-Au-Fe producing areas in China, where the mineralization is closely related to magmatism. The Shizishan magmatic-hydrothermal system is developed extensively in the Tongling ore district and has been well studied. Major whole-rock and trace element data comes from 34 rock samples of ore-related intrusions, microthermometry data of 32 fluid inclusion samples, trace element and REE data of 5 fluid inclusions of quartz samples, C−H−O is otopic data of 28 samples, and sulfur isotope data of 27 samples from representative deposits in the Tongling district. The Shizishan magmatic-hydrothermal system dataset probably reflects the characteristics of magmatic activities, the source and origin of ore-forming fluids and that of ore-forming materials.

Keywords: Tongling ore district; magmatic-hydrothermal system; Shizishan, Anhui province; geochemistry

Data service system URL: http://dcc.cgs.gov.cn

1 Introduction

1.1 Regional geological background

The Shizishan ore-forming fluid system developed in the Middle and Late Jurassic. It is mainly distributed in such zones as the Tongguanshan ore field, the Shizishan ore field (and Jiaochong and Yanchong districts to the south), the Fenghuangshan ore field, and the Shatanjiao ore field; occurrence locations are primarily concentrated in the contact zones of rock masses and surrounding rock. There are a few interlayered metasomatized and percolated skarns, which were mineralized and superimposed on an early massive sulfide ore bed in the Tongguanshan and Shizishan ore fields, forming a unique "multi-story" deposit. Whole-rock K/Ar dates of fresh rock masses have been calibrated as (152.99±2.85) Ma (Fenghuangshan granodiorite) and 135.3 Ma (Tongguanshan light gray quartz monzodiorite) (Zhou et al., 1987), with a gradually younging trend from east to west. Skarn-type mineralization is developed in rings and dots around the rock masses, and is distributed in clusters and belts in the Tongling ore concentration area, forming a fluid-activity domain exhibiting a column in the NE direction and a belt in

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the E−W direction. The magmatic fluid system at this stage was the most developed, with the most complete action types seen in the Shizishan ore field. The activity of the Shizishan magmatic fluid system had extremely large effects on the mineralization in the Tongling area, not only superimposing and transforming the pre-existing SEDEX-type massive pyrite bed into large-scale layered Cu deposits, e.g., Dongguashan, Songshushan, Laomiaojishan, Tianmashan, and Xingqiao, but also forming large quantities of skarn-type Cu-Fe-Au deposits, e.g., the Cu deposits in such zones as Xiaotongguanshan, Bishan, east Shizishan, west Shizishan, Datuanshan, Laoyaling, Fenghuangshan, and Shatanjiao (Fig. 1). This caused the mineralization in this area to reach its peak stage (Yang et al., 2004). Skarn-type mineralization is closely related to quartz monzodiorite and pyroxene monzodiorite, and is characterized by development of multiple types of skarn. Three are as follows: skarn type, e.g., west Shizishan (regionally comparable to the southern Wushan ore belt in Jiangxi, and Tonglushan in Hubei, etc.); cryptoexplosive breccia type, e.g., east Shizishan, and Yaoyuanshan (regionally comparable to Yangjishan in Jiangxi); and meso-epithermal vein type, e.g., Jiguanshi (comparable to Xiaomiaoshan in Dingxian County). The mineralization formed typical skarn-type mineral assemblages: garnet + diopside + magnetite belt – chalcopyrite + pyrite + pyrrhotite + (grammatite + actynolite) belt – quartz + calcite belt, of which the occurrence locations are primarily concentrated in the contact zone of rock masses and surrounding rock, with a few interlayered metasomatized and percolated skarns.

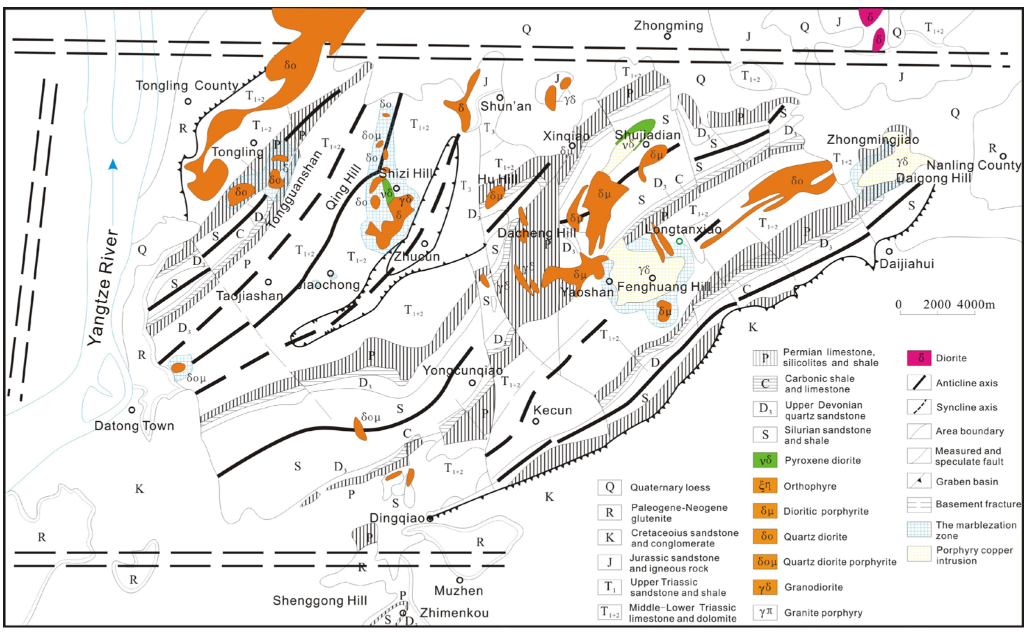

Fig.1 Distribution map of the magmatic hydrothermal system in the Tongling ore district (modified after 321 Geological Brigade)

1.2 Data meaning

The Tongling ore concentration area is one of the most well-studied Cu, Au and Fe producing areas in China, and the mineralization has a close relationship with the magmatism that produced the ores (Zhai et al., 1996; Zhai, 1992; Hou et al., 2011; Zhou et al., 2012). The Shizishan magmatic fluid system is distributed most widely, and is the principal part of magmatic activities and mineralization in the Tongling ore concentration area; numerous geologists have focused attention on this system (Guo Wenkui 1957; Guo Zongshan 1957; Chang Yinfo and Liu Xuegui, 1983, Chang Yinfo et al., 1991; Mao Jianren et al., 1990; Deng Jinfu et al., 1992; Wu, 1992; Tang Yongcheng et al., 1998; Xu Z W et al., 2005, 2007).The geochemical dataset retrieved from the Shizishan magmatic fluid system includes data of major and minor elements in the mineralization of rock masses, as well as the data of major and minor elements in and the micro-temperature measurement and stable isotope data of fluid inclusions. Such information can reflect the magmatic activity characteristics, ore-forming fluid characteristics, and ore-forming material sources of the Shizishan magmatic fluid system, having important reference values for disclosing the deposit genesis, ore-forming fluids, and ore-forming material sources.

1.3 Brief introduction to dataset metadata

A brief table of metadata of the geochemical dataset of the Shizishan magmatic fluid system in the Tongling ore concentration area is shown in Table 1. The table includes the Chinese (English) name of the dataset, data acquisition date, geographic area, data volume, data format, data press address, foundation projects, and database (set) composition.

Table 1 Metadata table of dataset(s)

Items	Description
Database (dataset) name	Geochemical Dataset of Shizishan Magmatic-hydrothermal System in the Tongling Ore District
Data acquisition time	2001—2005
Geographic area	Tongling Area, Anhui Province
Data size	98 kB
Data format	.xlsx
Data service system URL	http://dcc.cgs.gov.cn/
Foundation items	Large-scale comprehensive research project of science and technology of Ministry of Land and Resources (No. 20010103)
Database (set) composition	Dataset comprises 3 sections, and 7 data tables in total. Section 1:analysis results of whole-rock major and minor elements in the magmatic rock of the Shizishan magmatic fluid system, including "Table 1−1 Table of major elements in the mineralization rock masses of the Shizishan magmatic fluid system", and "Table 1−2 Table of minor and rare earth elements in the magmatic rock of the Shizishan magmatic fluid system" Section 2: data of micro-temperature measurement, minor and rare earth elements, and liquid-phase components of fluid inclusions in the Shizishan magmatic fluid system, including "Table 2−1 Table of homogenization temperature measurement results of fluid inclusions in the Shizishan magmatic fluid system", "Table 2−2 Table of characteristics of rare earth elements in quartz inclusions from deposits in the Tongling area", and "Table 2−3 Table of characteristics of minor elements in quartz inclusions from deposits in the Tongling area" Section 3: data of C-H-O-S stable isotopes in the Shizishan magmatic fluid system, including "Table 3−1 Test results of C, H and O isotopes in the Shizishan magmatic fluid system", and "Table 3−2 Test results of S isotopes of representative deposits in the Tongling area"

2 Data acquisition and processing methods

2.1 Sample collection

Mineralization rock mass samples from the Shizishan magmatic fluid system were taken from fresh quartz monzonite, quartz diorite, granodiorite, and magmatic rock with weak alterations including skarnization, potash feldspathization and silicification, from such representative deposits in the system as Xingqiao, Fenghuangshan, east Shizishan, and Tongguanshan.

Sampling and test of fluid inclusions: The test samples were from several main ore districts related to magmatic rock in the Tongling ore concentration area, including Tongguanshan, Chaoshan, Dongguashan, and Fengxianggengchen of Fenghuangshan. Quartz and calcite related to magmatic activities were selected for grinding preparation of inclusion sheets.

S isotope samples for pyrite, chalcopyrite and pyrogelite were collected from skarn and Cu-Fe ore from representative deposits of the Shizishan magmatic fluid system, including Xingqiao, Fenghuangshan, east Shizishan, Tongguanshan, and Jiguanshi.

The C−H−O isotope samples for marble, skarn and calcite came from representative deposits of the Shizishan magmatic fluid system.

2.2 Analysis methods

In this study, geochemical analysis were conducted on magmatic rock samples closely related to the mineralization in the Shizishan magmatic fluid system of the Tongling ore concentration area, including 34 samples for whole-rock major elements and 18 samples for analysis of rare earth and minor elements. All analyses were completed in the laboratory of the Institute of Geophysical and Geochemical Exploration, Chinese Academy of Geological Sciences, Beijing; the analysis of whole-rock major elements were conducted using X−ray fluorescence spectrometry (XRF), and determination of minor elements was conducted using the ICPMS method.

The micro-temperature measurement for fluid inclusions was performed with a THMS600 hot-cold stage made by Linkam Company, and completed at the University of Science & Technology Beijing. The technical parameters of the test instrument were as follows: platinum resistance sensor, controlled stable temperature ±0.01℃ , minimum display division of 0.01℃ , temperature measurement range of −196 to 600℃ , axial movement distance of sample of 16 mm, light aperture of 1.3 mm, and heating/refrigerating rate of 0.01℃ to130℃ / min. KNO_3, CCl_4, K_2CrO_3 and artificially prepared NaCl standard solution were the reference materials for calibration, ±2℃ was the error relative to reference materials at 400℃ , and ±0.1℃ was the error relative to reference materials at −22℃ . In general, 10℃ /min was set as the temperature control rate during heating or refrigerating, and a rate less than 1℃ / min was set near the transformation temperature. The magnification used was x100–800 with an OLMPUS0BX51 optical microscope. The temperature measurement process for inclusions was as follows: Cool down with liquid nitrogen → Observe the change of the inclusion during refrigeration → Allow temperature to rise slowly, and control the rate near the transformation temperature → Observe and record the three-phase point, freezing point, and clathrate disappearing temperature, etc.

The analysis of the S isotopes of the ore minerals was conducted at the Open Laboratory for Isotopes, Chinese Academy of Geological Sciences, and the analysis of the C-H-O isotopes of marble, skarn and calcite was conducted at the Analytical Laboratory, Beijing Research Institute of Uranium Geology. The test instrument was an MAT-253 mass spectrometer. For analysis of O isotopes, the sample was crushed first, and sieved through 40–60 meshes; and then the sample was observed under a binocular eyepiece, and pure single minerals were sorted out; the purity should be over 99%. After the treated sample was washed, and the adsorbed water and secondary inclusions were removed from the sample, study was conducted. The analysis of O isotopes was performed using the BrF_5 method (Clayton et al, 1963); first 12 mg was sorted out from the pure sample, and allowed to react with BrF_5 for 15 h, and then O_2 was extracted; the extracted O_2 was introduced into a CO_2 conversion system set to 700℃ and 12 min, and CO_2 was prepared and collected. For analysis of H isotopes, H_2 was extracted using the vacuum burst and zinc reduction methods. The inclusion sample was first heated to burst temperature, with volatiles released and steam extracted, and then the water and zinc were allowed to react at 400 ℃ , producing H_2 (Coleman et al., 1982), which was cooled with liquid nitrogen, and stored in bottles with activated carbon. The SMOW was taken as standard for the analysis results of both H and O isotopes. The analysis accuracy of H isotopes was ±2%, and that of O isotopes was ±0.2%. The 100% phosphoric acid method was used for the C−O isotopes. The V−PDB was taken as standard for the analysis results of $\delta^{13}C$, and the V−PDB and SMOW were taken as standards respectively for the analysis results of $\delta^{18}O$; for calculating $\delta^{18}O$, the formula given by Coplen et al. (1983) was employed: $\delta^{18}O_{SMOW}=1.03091\times\delta^{18}O_{PDB}+30.91$. The analysis accuracy was better than 0.05‰ for $\delta^{13}C$, and better than 0.10‰ for $\delta^{18}O$.

3 Description of data samples

The geochemical dataset of the Shizishan magmatic fluid system in the Tongling ore concentration area is kept as Excel sheet type data, including 3 sections and 7 Excel data files (see Table 1). Section 1 gives whole rock analysis results of major and minor elements in the magmatic rock, with Table 1−1 and Table 1−2. Section 2 is micro-temperature measurement, minor and rare earth elements, and liquid-phase components of the fluid inclusions including Table 2−1 homogenization temperature measurement results, Table 2−2 characteristics of the rare earth elements in the quartz inclusions and Table 2−3 characteristics of the minor elements in quartz inclusions from deposits in the Tongling area. Section 3 is the C−H−O−S stable isotope data including Table 3−1 C−H−O isotope test results and Table 3−2 S isotope test results of representative deposits in the Tongling area. A data file "Table of analysis results of major and minor elements in magmatic rock of the Shizishan magmatic fluid system" describes the information on the sampling positions of and the major elements in 34 rock samples from rock masses closely related to mineralization (Table 2); "Table of minor and rare earth elements in magmatic rock of the Shizishan magmatic fluid system" describes the information on the sampling positions of the minor and rare earth elements in 18 samples (Table 3); "Table of homogenization temperature measurement results of fluid inclusions in the Shizishan magmatic fluid system" describes the information on homogenization temperatures of quartz and calcite inclusions in 32 rock samples related to magmatic activities (Table 4); further tables give characteristics of rare earth elements and minor elements in 4 quartz inclusions from samples from deposits in the Tongling area (Tables 5 and 6); information on C, O and H isotope compositions in 28 samples from the hydrothermal system related to the Shizishan magmatic fluid system is given in Table 7; and the test results of S isotopes in 27 samples from representative deposits in the Tongling area is shown in Table 8.

Table 2　Table content of Major element data of magmatic rock in Shizishan magmatic system

number	field name	dimension	data type	Examples
1	Sample number		character type	L1−1−1
2	Producing area		character type	Xinqiaotou
3	lithology		character type	Light grey coarse spot granodiorite
4	Test elements		character type	SiO_2
5	Element contents	%	floating point	58.96

Table 3　Table content of trace element data of magmatic rock in the Shizishan magmatic system

number	field name	dimension	data type	Examples
1	Sample number		character type	L1−1−1
2	Producing area		character type	Xinqiaotou
3	lithology		character type	Light grey coarse spot granodiorite
3	Test elements		character type	La
4	Element contents	10^{-6}	floating point	26.6

Table 4　Table content of homogenization temperature data of fluid inclusions in the Shizishan magmatic system

number	field name	dimension	data type	Examples
1	Sample number		character type	C43−8−2
2	Sampling position		character type	Chaoshan
3	test object		character type	quartz
4	homogeneous temperature range	℃	character type	276.9−417.0
5	Average homogeneous temperature	℃	floating point	363.9

Table 5　Table content of REE data in fluid inclusions of quartz in the Tongling ore district

number	field name	dimension	data type	Examples
1	Sample number		character type	TGS-4
2	Sampling position		character type	Tongguan Mountain
3	test object		character type	Quartz inclusion
4	Test elements		character type	La
5	Element contents	10^{-9}	floating point	0.11
6	H_2O	μL/g	floating point	0.116

Table 6 Table content of trace element data in fluid inclusions of quartz in the Tongling ore district

number	field name	dimension	data type	Examples
1	Sample number		character type	TGS−4
2	Sampling position		character type	Tongguan Mountain
3	test object		character type	Quartz inclusion
4	Test elements		character type	Li
5	Elements contents		floating point	0.972
6	Feature element parameter		character type	Co/Ni
7	Feature element content ratio		floating point	0.18

Table 7 Table content of C, H and O isotopic composition of the ore-forming fluids in the Shizishan magmatic system

number	field name	dimension	data type	Examples
1	Sample number		character type	C120−19−10
2	Rock name		character type	Pyrite-containing limestone
3	Sampling position		character type	Chaoshan
4	Test object		character type	Calcite
6	$\delta^{18}O_{SMOW}$		floating point	22.5
7	$\delta^{13}C_{PDB}$	‰	floating point	3.6
8	$\delta^{18}O_{H2O}$	‰	floating point	18.4
9	δD	‰	floating point	-39

Table 8 Table content of sulfur isotope data from representative deposits in Tongling district

number	field name	dimension	data type	Examples
1	Sample number		character type	III−1
2	Producing area		character type	Xinqiao
3	Sample name		character type	Quartz pyrite diorite porphyry
4	Single mineral species		character type	Disseminated pyrite
6	$\delta^{34}S_{VCDT}$	‰	floating point	2.5

4 Data quality control and evaluation

4.1 Analysis of major elements and minor elements

The relative error of analysis of major elements is better than 5%; in analysis of minor elements (including rare earth elements), the relative error is less than 5% when the element content is more than 10×10^{-6}, and less than 10% when the element content is less than 10×10^{-6}.

4.2 Micro-temperature measurement data of fluid inclusions

KNO_3, CCl_4, K_2CrO_3 and an artificially prepared NaCl standard solution were reference materials for instrument calibration, ±2 ℃ was the error relative to reference materials at

400℃ , and ±0.1℃ was an error relative to reference materials at −22℃ . The quantity of inclusions tested was from 10 to over 20.

4.3 Analysis of stable isotopes

The analysis accuracy of H isotopes was ±2%, and that of O isotopes was ±0.2%. The analysis accuracy was better than 0.05‰ for $\delta^{13}C$, and better than 0.10‰ for $\delta^{18}O$.

5 Conclusions

The geochemical dataset of the Shizishan magmatic fluid system is a set of systematic data, including that of major and minor elements in the main mineralization rock masses, and of major and minor elements in and the micro-temperature measurements and stable isotopes of the fluid inclusions. This dataset can systematically reflect the magmatic activity characteristics, ore-forming fluid characteristics and ore-forming material sources of the Shizishan magmatic fluid system, providing data support for and having important reference value for disclosing such scientific questions as the deposit genesis, ore-forming fluids, and ore-forming material sources and evolution.

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