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上扬子北缘川北地区结晶基底晶质石墨矿数据集

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摘要：上扬子北缘川北地区出露的基底地层发育双层结构，其中上层的褶皱基底早已发现尖山、坪河、庙坪等中—大型、超大型石墨矿；但是直到最近，才在下层的结晶基底后河岩群汪家坪岩组细粒石英岩中发现了石墨矿。该矿体长约 200 米，宽约 6.7 米，矿体平均厚度 4.9 米，矿石平均品位 5.13%。矿物组合为：石英+石墨+云母+黄铁矿+赤铁矿。该成果在上扬子北缘地区的发现，扩大了该区域的找矿前景，为区内晶质石墨矿的找矿工作提供了新的方向，同时为四川巴中地区超大型晶质石墨矿基地建设提供了新的资源潜力保障。数据集包括 Excel 表格数据，2 个*.xls 类型文件，记录了样品固定碳测试结果和氧化物测试数据。

关键词：石墨矿；结晶基底；上扬子；后河岩群；数据集

数据服务系统网址：http://dcc.cgs.gov.cn

1 引言

中国区域变质型石墨矿床主要分布于古老地台、地块周缘，如分布于华北地台北缘的内蒙古的兴和石墨矿、东缘的山东南墅石墨矿、南缘的河南鲁山县背孜石墨矿，扬子地台的西缘四川攀枝花中坝石墨矿、北缘的湖北宜昌三岔垭等矿床 (李超等，2015)。中国北方石墨矿大多数都产出于结晶基底当中 (刘金中等，1989；莫如爵等，1989；李寒滨和张冰，2014；李超等，2015；刘敬党和肖荣阁，2015；孙厚江等，1995；杨培奇等，2017)；其次产出于浅变质岩系中。在中国南方，在扬子地台发现的石墨矿床主要产出于褶皱基底层中 (高显忠，2015；王红军等，2017；夏锦胜等, 2017a，b；马彩凤等，2018；马志鑫等，2018)，如四川攀枝花盐边群中的中坝石墨矿床、云南牟定苴林群中的戌街石墨矿床、四川南江火地垭群中的尖山、坪河、庙坪等石墨矿床。石墨矿的成因主要为区域变质及构造变质作用，碳质来源于有机质 (马志鑫等，2018)。“上扬子北缘结晶基底晶质石墨矿”是中国地质调查局成都地质调查中心承担的中国地质调查局

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地质调查项目“龙门山—滇中成矿带通安—宁蒗地区地质矿产调查”下属子项目“四川南江地区关坝—南江矿产地质调查”的工作成果。项目完成了 1∶50 000 矿调地质填图、水系沉积物测量、遥感地质解译各 840 km^2（关坝幅、南江幅，共 2 幅图），并对发现和圈定的赖宜梁、大坝（本点）、新立、熊家湾、玉泉等矿点或异常进行了检查。项目通过四川北部南江开展的矿产地质调查工作，在结晶基底后河岩群中发现了晶质石墨矿。

川北南江地区出露的前震旦系的变质岩系遭受了多期变形变质及岩浆活动的影响。根据其原岩建造、变质作用类型、构造变形样式及同位素年代学等特征，前人将其划分为结晶基底和褶皱基底 (何政伟等，1997；刘援朝等，1997)。川北南江地区出露的结晶基底主要为后河岩群汪家坪岩组，褶皱基底为火地垭群上两组、麻窝子组（图 1）。汪家坪组地层以灰色条纹状—条带状黑云斜长变粒岩、含石榴黑云斜长变粒岩、二云斜长变粒岩为主。上两组以片岩、千枚岩为主，中部含斑点状石榴石红柱石片岩、绿泥石片岩等。麻窝子组主要为大理岩与片岩、千枚岩组合，中部以大理岩为主，为区内石墨矿的主要产出层位。本次工作在南江大坝工作区的后河岩群汪家坪岩组中发现细粒石英岩，并在其中发现了晶质石墨矿。

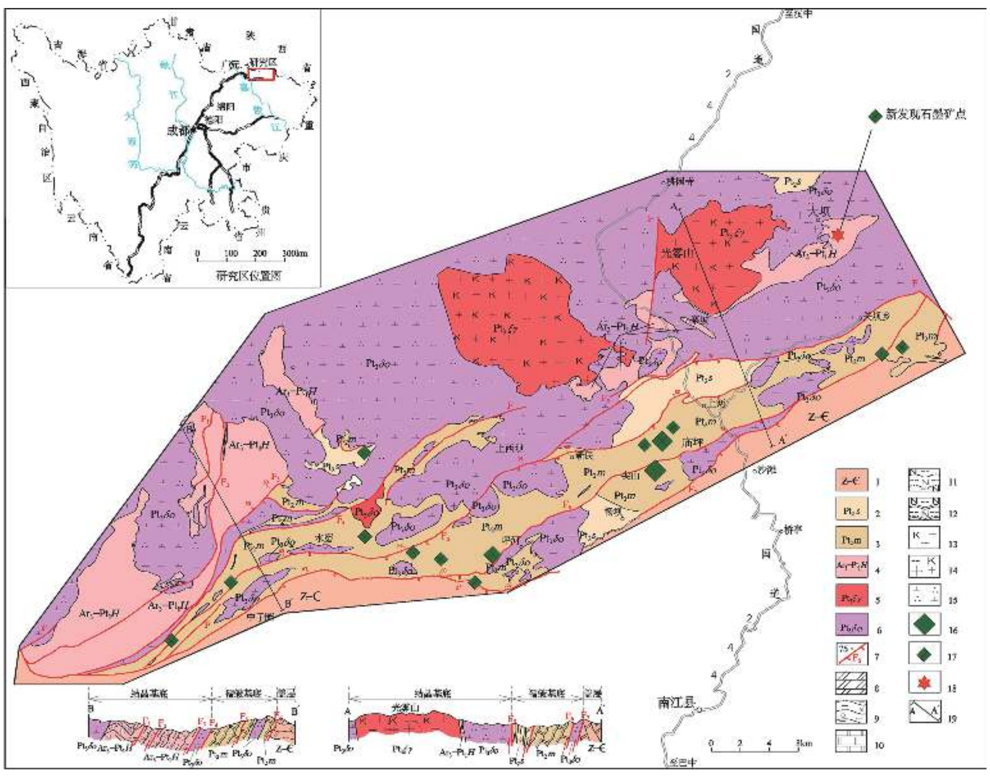

图 1　上扬子北缘川北地区基底结构及新发现石墨矿位置图

（综合 1∶200 000、1∶50 000 区调及本次矿调工作修编）基底具双层结构：上层褶皱基底，为火地垭群变质岩，包括上两组、麻窝子组。岩石变质程度低，多为低绿片岩相–绿片岩相。主要岩石为板岩、千枚岩、片岩和大理岩或浅变质灰岩（白云岩），原岩为沉积岩。下层结晶基底，为后河岩群。岩石强烈变形变质，达麻粒岩相–角闪岩相。主要岩石为变粒岩、石英岩、片麻岩、片麻状花岗岩及角闪片岩等，原岩为火成岩、部分为沉积岩。由于后期构造岩浆活动，结晶基底被断层推覆于褶皱基底之上，而褶皱基底有时又叠置于盖层之上。1—震旦系–寒武系；2—中元古界上两组；3—中元古界麻窝子组；4—新太古界后河岩群；5—新元古界钾长花岗岩；6—新元古界石英闪长岩；7—断层及产状；8—白云岩；9—含石榴黑云片岩；10—大理岩；11—黑云斜长变粒岩；12—（凝灰）黑云斜长片麻岩；13—钾长花岗岩；14—似斑状钾长花岗岩；15—石英闪长岩；16—大型石墨矿床；17—石墨矿（点）；18—新发现石墨矿点；19—图切剖面位置

含矿岩系主要为深灰色—灰黑色变质石英岩，出露宽度约 300 米，发育南东方向、南西方向两组节理，南东方向节理面上见石墨矿化。石墨矿化体出露宽度 6.70 米，走向 200 米，平均厚度 4.9 米，平均品位 4.6%。赋矿岩石为细粒石英岩，岩石呈块状，主要成分为石英，次见石墨、云母、黄铁矿、赤铁矿。

石墨矿主要表现为块状、条带状、角砾状三种构造特征（图 2A、C、D）。块状石墨矿（图 2A）：风化面呈深灰色，具褐铁矿化，新鲜面为黑色，细粒变晶结构，块状构造。条带状石墨矿（图 2C）：呈黑色，与白色石英条带相间产出，两者宽度大致相当，约 2 ~ 3 mm，延伸不稳定。角砾状石墨矿（图 2D）：该类型较少，为含硅质的热液沿裂隙构造裂隙贯入时形成的角砾岩；角砾成分为含石墨大理岩，角砾多呈次棱角状，胶结物为石英，呈基底式胶结，厚度约 8 cm。

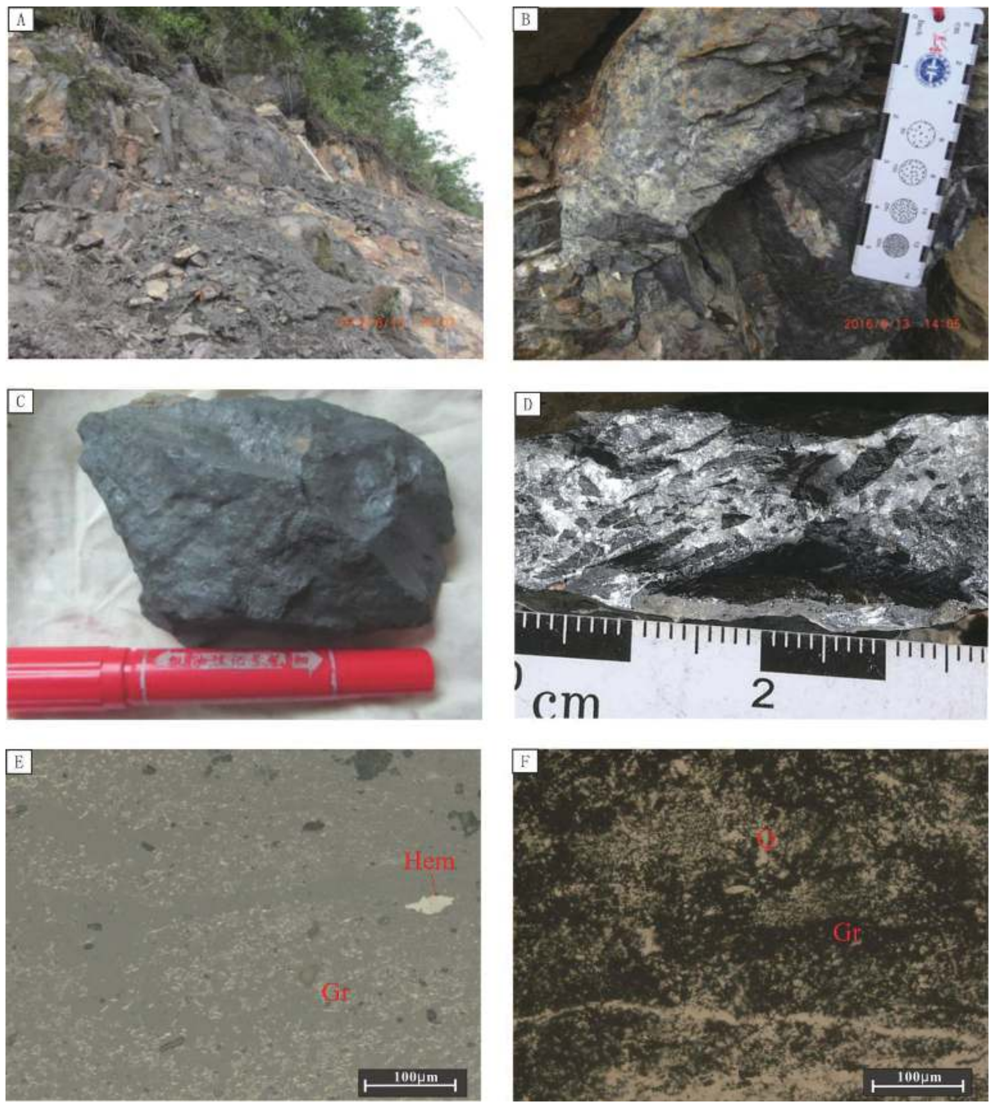

图 2　后河岩群汪家坪组石墨矿矿化特征

A–石墨矿露头；B–石英细脉；C–块状石墨矿石；D–角砾状石墨矿石；E–矿石光片（Gr 石墨，Hem 赤铁矿）；F–矿石薄片（Gr 石墨，Q 石英）

上扬子北缘川北地区结晶基底晶质石墨矿数据集的元数据简表见表 1。

表 1　数据库（集）元数据简表

条目	描述
数据库（集）名称	上扬子北缘川北地区结晶基底晶质石墨矿数据集
数据库（集）作者	罗茂金，中国地质调查局成都地质调查中心 马志鑫，中国地质调查局成都地质调查中心 孙志明，中国地质调查局成都地质调查中心 黄　腾，四川冶金局605地质队 任京伟，成都理工大学 姜　岩，四川冶金局605地质队
数据时间范围	2016—2018年
地理区域	四川省川北地区（南江县）
数据格式	*.xlsx
数据量	上扬子北缘结晶基底石墨矿TC51固定碳分析结果表，数据量大小14 kb 上扬子北缘结晶基底石墨矿TC51氧化物分析结果表，数据量大小32 kb
数据服务系统网址	http://dcc.cgs.gov.cn
基金项目	中国地质调查局地质调查项目“龙门山—滇中成矿带通安—宁蒗地区地质矿产调查”（DD20160017）资助
语种	中文
数据库（集）组成	该数据集是由2个Excel表格组成，表格名称分别“上扬子北缘结晶基底石墨矿TC51固定碳分析结果表”、“上扬子北缘结晶基底石墨矿TC51氧化物分析结果表”。

2　数据采集和处理方法

2.1　样品采集

在地质填图过程中，巧遇高压输电线施工形成的“探槽”，进行观察发现石墨矿，并对其进行采样，共采集样品 7 个，样品特征见表 2。现场根据石墨矿化强弱、岩石破碎程度，以及热液活动特征进行分段布样。共控制石墨矿化宽度 6.70 米，走向追索 200 米后为土掩盖。赋矿岩石为细粒石英岩，主要成份为石英，次见石墨、云母、黄铁矿、赤铁矿。岩石局部强劈理化，石英细脉发育，石墨含量相对较高（如图 2A、2B）。

表 2　样品特征表

样号	岩矿石名称	样长（m）	固定碳含量（%）
H1	条带状石墨矿化石英岩	1.00	4.34
H2	碎裂石墨矿化石英岩	1.00	9.44
H3	石墨矿化石英岩	1.50	3.70
H4	石墨矿化石英岩	1.40	4.05
H5	硅化石墨矿化石英岩	1.00	7.79
H6	石墨矿化石英岩	0.80	2.02
H7	黑色石英岩	1.00	0.995

2.2　测试方法

样品委托测试单位为西南冶金地质测试中心，其固定碳测试仪器设备为管式燃烧

炉；测试依据按 DZG20-02-1991《岩石矿物分析》；氧化物测试仪器设备为：Vista-MPX 等离子光谱仪、DY938 X 射线光谱仪、管式燃烧炉、CP124S 电子天平 2、Z-2000 原子吸收分光度计、滴定管等。

试样中固定碳以非水滴定法进行测定，方法编号为 DZG-02-1991。试样经硝酸和高温处理，除去碳酸盐和有机碳，然后在氧气流中经高温灼烧，产生的二氧化碳被吸收液吸收，用百里酚酞做指示剂，以乙醇钾标准溶液滴定得固定碳量。

3　数据样本描述

上扬子北缘川北地区结晶基底晶质石墨矿数据集主要包括以下几个方面：结晶基底和褶皱基底展布、主要石墨矿床（点）分布、本次采样点位置、上扬子北缘川北地区结晶基底晶质石墨矿 TC51 固定碳分析结果表、上扬子北缘川北地区结晶基底晶质石墨矿 TC51 氧化物分析结果表。

“上扬子北缘川北地区结晶基底晶质石墨矿 TC51 固定碳分析结果表”（表 3）包含如下内容：样号、分析号、样长（m）、固定碳含量（%）。

表 3　TC51 固定碳分析结果表

序号	字段名称	量纲	数据类型	实例
1	样号	无	字符串	TC51-H1
2	分析号	无	字符串	A171960115
3	固定碳	%	浮点型	4.34

“上扬子北缘川北地区结晶基底晶质石墨矿 TC51 氧化物分析结果表”（表 4）包含如下内容：样号、分析号、样长（m）、测试项目 19 项包括 SiO_2、Al_2O_3、Fe_2O_3、TFe、FeO、CaO、MgO、K_2O、Na_2O、TiO_2、P_2O_5、S、H_2O^+、H_2O^-、V_2O_5、CO_2、Cu、灰份、挥发份等。

表 4　TC51 氧化物分析结果表

序号	字段名称	量纲	数据类型	实例
1	样号	无	字符串	TC51-H1
2	分析号	无	字符串	A174340098
3	SiO_2	%	浮点型	84.97
4	Al_2O_3	%	浮点型	2.82
5	Fe_2O_3	%	浮点型	2.04
6	TFe	%	浮点型	2.25
7	FeO	%	浮点型	1.06
8	CaO	%	浮点型	0.780
9	MgO	%	浮点型	0.640
10	K_2O	%	浮点型	0.796
11	Na_2O	%	浮点型	0.057
12	TiO_2	%	浮点型	0.137
13	P_2O_5	%	浮点型	0.616
14	S	%	浮点型	0.049

续表 4

序号	字段名称	量纲	数据类型	实例
15	H_2O^+	%	浮点型	0.924
16	H_2O^-	%	浮点型	0.403
17	V_2O_5	%	浮点型	0.007
18	CO_2	%	浮点型	0.265
19	Cu	%	浮点型	0.019
20	灰份	%	浮点型	94.11
21	挥发份	%	浮点型	2.16

4 数据质量控制和评估

项目工作按中国地质调查局 2015 年 8 月发布的《1∶50 000 矿产地质调查工作指南》实施，野外定位采样数字地质调查系统（DGSS）进行定位。对发现的矿化点进行了探槽编录和刻槽采样。采集的样品全部送西南冶金地质测试中心进行加工、分析，内部检查样全部合格。由于石墨矿总体样品较少，没有抽送外检。

5 数据价值

本数据为首次在上扬子陆块北缘结晶基底后河岩群汪家坪岩组石英岩中发现的晶质石墨矿的原始数据。该数据丰富了石墨矿成矿类型、拓展了石墨矿成矿时代，为石墨矿的理论研究提供了新的数据样本。同时，新发现的含矿地层在上扬子北缘及周缘分布广泛，该数据为片区石墨矿的找矿提供了新的方向和部署思路，为通南巴地区进一步找矿突破和全面脱贫攻坚提供了有力支撑。

6 结论

1. 通过路线追索、实测剖面、刻槽取样、岩矿测试等对大坝石墨矿特征进行了具体调查分析，发现大坝石墨矿化特征较好。矿体延伸 200 米，出露宽度 6.70 米，宽体平均厚度 4.90 米，平均品位 5.13%。根据区内坪河石墨矿建立的典型矿床模型，采用地质体积法对大坝石墨矿进行了资源潜力预测，在 12 平方千米范围内获得预测资源量 173.80 万吨。

2. 大坝后河岩群汪家坪岩组石墨矿的发现，是该区域初次在结晶基底中发现石墨矿，为川北地区，甚至整个上扬子北缘地区的石墨矿找矿工作带来新的思路和找矿方向。

3. 四川巴中超大型晶质石墨矿基地是《全国矿产资源规划（2016—2020）》确定的 6 大石墨矿资源基底之一。目前巴中市政府正大力推进工作的建设，新类型石墨矿的发现为此提供新的资源潜力。

4. 项目工作开展后，在巴中市政府引进下，社会资本在成矿带上开展石墨矿的找矿工作积极向好，为通江—南江—巴中贫困区带来了就业改善和地区经济进一步发展，为老区精准脱贫提供了助力。

致谢：本数据集是中国地质调查局地质调查项目“龙门山—滇中成矿带通安—宁蒗地区地质矿产调查”下设的子项目“四川南江地区矿产地质调查”的集体发现成果。其中，邹光富、廖均参与了前期的地质填图工作并发现了该石墨矿点，何龙、陈卓、潘伟奇参与了后期工程编录及采样工作。中国地质调查局成都地质调查中心王立全、

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Crystalline-Basement Crystalline Graphite Deposit Dataset on the Northern Margin of the Upper Yangtze and North Sichuan

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Abstract: The basement strata outcropping on the northern margin of the upper Yangtze and North Sichuan have developed a dual-layer structure, where medium–large and extra-large graphite deposits have been found at Jianshan, Pinghe and Miaoping etc., which are located on fold basements in the upper layer. Until recently, however, a graphite deposit is found in fine-grain quartzite of the Wangjiaping Formation, Houhe Group complex of the crystalline basement in its lower part. The rock mass is about 200 m long, 6.7 m wide, 4.9 m thick on average and 5.13% in average grade. The ore combination is quartz + graphite + mica + pyrite + hematite. This discovery on the northern margin of the upper Yangtze expands the prospecting foreground in the region, provides new opportunities to prospect crystalline graphite ores therein and gives a new guarantee in resource potential to build an extra-large crystalline graphite ore base in Bazhong, Sichuan. The dataset contains data in Excel sheets, including 2 type files *.xls, recording results from fixed carbon testing of samples and data from oxide testing.

Key words: Graphite deposit; Crystalline basement; Upper Yangtze; Houhe complex Group; Dataset

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

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1 Introduction

In China, regional metamorphic graphite deposits are mainly distributed on the periphery of ancient platforms and blocks, for instance, those found at Xinghe, Inner Mongolia, Nashu, Shandong, and Beizishi, Lushan County, Henan, on the northern, eastern and southern margins of the North China Platform, respectively; and Zhongba, Panzhihua, Sichuan, and Sanchaya, Yichang, Hubei, on the western and northern margins of the Yangtze Platform (Li C et al., 2015). In the north of China, graphite deposits mostly occur in crystalline basements (Liu JZ et al., 1989; Mo RJ et al., 1989; Li HB and Zhang B, 2014; Li C et al., 2015; Liu JD and Xiao RG, 2015; Sun HJ et al., 1995; Yang PQ et al., 2017), and less so in epimetamorphic rock series. In south China, graphite deposits found on the Yangtze Platform mainly occur in fold basements (Gao XZ, 2015; Wang HJ et al., 2017; Xia JS et al., 2017a, b; Ma CF et al., 2018; Ma ZX et al., 2018), for instance those at: Zhongba in the Yanbian Group complex, Panzhihua, Sichuan; Qujie in the Julin Group complex, Mouding, Yunnan; and Jianshan, Pinghe and Miaoping in the Huodiya Group complex, Nanjiang, Sichuan. Graphite deposits mainly are generated from regional and structural metamorphism whereas carbon comes from organic matter (Ma ZX et al., 2018). "Crystalline basement crystalline graphite deposit in the north margin of upper Yangtze" is the outcome of the sub-project "Guanba-Nanjiang geological survey in Nanjiang, Sichuang" under the China Geological Survey (CGS) geological survey project "Tongan–Ninglang Geological Mineral Survey in Longmen Mountain–Central Yunnan Metallogenic Zone" undertaken by the CGS Chengdu Geological Survey Center. The project completed 1:50 000 mineral-survey geological mapping, stream sediment measurements and remote-sensing geological interpretation, at 840 km^2 each (2 map sheets: Guanba and Nanjiang) and examined mineral points discovered or delineated, such as Laiyiliang, Daba, Xinli, Xiongjiawan and Yuquan, or anomalies therein. Through the mineral geological survey done in Nanjiang, in north Sichuan, the project discovered crystalline graphite deposits in the Houhe Group complex of the crystalline basement.

The metamorphic rock series of the pre-Sinian system to which outcrops in Nanjiang, north Sichuan, belong, has been affected by multiple periods of deformation, metamorphism and magmatism. Based on its characteristics, such as its protolith formation, metamorphic type, tectonic deformation pattern and isotope chronology, it has been divided into crystalline basement and fold basement (He ZW et al., 1997; Liu YC et al., 1997). The crystalline basement that outcrops in Nanjiang, Sichuan, is mainly the Houhe Group-complex Wangjiaping Formation and the fold basements are the Shangliang Formation and Mawozi Formation of the Huodiya Group-complex (Fig. 1). Strata in the Wangjiaping Formation are mainly gray streaky-banded biotite plagioclase granulite, garnet-bearing biotite, plagioclase granulite and two-mica plagioclase granulite. The Shangliang Formation mainly contains schist and phyllite, and its central part contains mottled garnet andalusite schist, etc. The Mawozi Formation mainly contains marble combined with schist and phyllite and its central part contains mainly marble, which is a main horizon of graphite ore in the area. In the Houhe

Group-complex Wangjiaping Formation of the Nanjiang Dam work area, the project found fine-grain quartzite in which crystalline graphite ore was discovered.

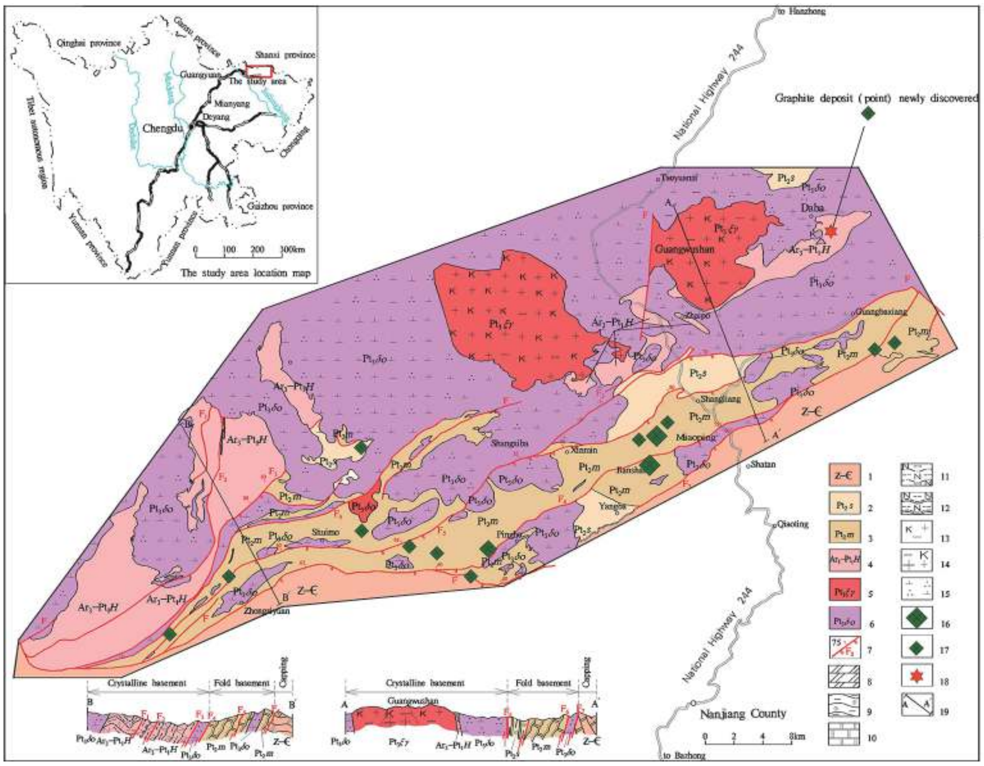

Fig. 1 Basement structure on the northern margin of the Upper Yangtze and northern Sichuan as well as location of newly discovered graphite deposit

(1:200 000 and 1:50 000 regional survey and this mineral survey are combined)Basement is structured in two layers: the upper layer is fold basement, the Huodiya Group-complex metamorphic rocks, consisting of the Shangliang Formation and the Mawozi Formation. The rock is low in metamorphic grade, and mostly low green-schist facies ~ green-schist facies. It mainly contains slate, phyllite, schist and marble or epimetamorphic limestone (dolomite), and its protolith is sedimentary rock. The lower layer is crystalline basement of the Houhe Group complex. The rock is strongly deformed and metamorphic, of granulite facies ~ amphibolite facies. It mainly contains granulite, quartzite, gneiss, gneissoid granite and amphibolite schist etc., and its protolith is igneous rock, and partly sedimentary rock. Due to late structural magmatism, the crystalline basement is pushed over the fold basement by faults, and sometimes the fold basement overlies the capping.1−Sinian system-Cambrian system; 2−Mid-Proterozoic-erathem Shangliang formation; 3−Mid-Proterozoic-erathem Mawozi formation; 4−Neo-Archaeozoic-erathem Houhe group complex; 5−Neo-Proterozoic-erathem moyite; 6−Neo-Proterozoic-erathem quartz diorite; 7−Fault and altitude; 8−Dolomite; 9−Garnet-bearing biotite schist; 10−Marble; 11−Biotite plagioclase granulite; 12−(Tuff) biotite plagioclase schist; 13−Moyite; 14−Porphyritic moyite; 15−Quartz diorite; 16−Large graphite deposit; 17−Graphite ore (point); 18−Newly discovered graphite ore point; 19− Graph-cut profile location

The ore-bearing series is mainly dark-gray to gray-black metamorphic quartzite, with about 300 m wide outcrops. It has two developed groups with joints in SE and SW directions, respectively, and graphite mineralization is seen on the SE joint surface. The graphite mineralized body is 6.70 m wide for its outcrop, 200 m long in strike, 4.9 m in average thickness and 4.6% in average grade. The host rock is fined-grain quartzite, which is in block form, and contains mainly quartz, and then graphite, mica, pyrite and hematite.

The graphite deposits have three structural features: blocky, banded and brecciated (Fig. 2A, C and D). The block graphite deposit (Fig. 2A) is dark-gray on its weathered surface, limonite-mineralized, black on the fresh surface, with fine-grain ferritization, and blocky structure. The banded graphite deposit (Fig. 2C) is black, occurring alternated with white quartz strips, both are about 2~3 mm wide, with unstable extensions. The brecciated graphite deposit (Fig. 2D) is a lesser type, breccia that is generated when siliceous hydrothermal solution flows in the fissures of fractures; it contains graphite-bearing marble, with breccia mostly subangular, and quartz is cemented in the basement. It is about 8 cm thick.

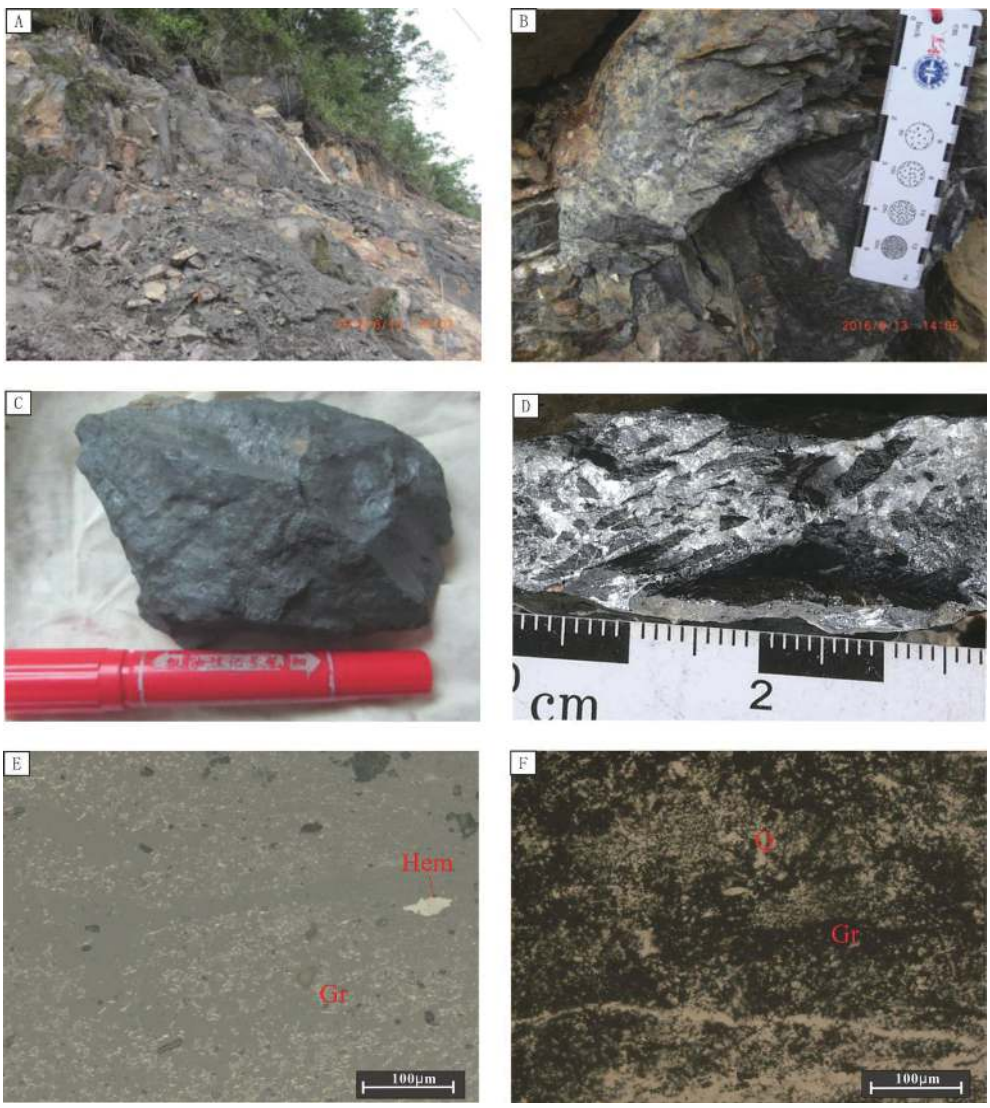

Fig. 2 Mineralization features of the Houhe Group-complex Wangjiaping Formation graphite deposit

A−outcrops of graphite deposit; B−quartz stringer; C−blocky graphite ore; D−brecciated graphite ore; E−polished ore section (Gr: graphite; Hem: hematite); F−thin ore section (Gr: graphite; Q: quartz)

Metadata in the crystalline-basement crystalline graphite deposit dataset from the northern margin of the upper Yangtze and North Sichuan are shown briefly in Table 1.

Table 1 Metadata Table of Database (Dataset)

Items	Description
Database(dataset) name	Crystalline-Basement Crystalline Graphite Deposit Dataset on the Northern Margin of the Upper Yangtze and North Sichuan
Database(dataset) authors	Luo Maojin, Chengdu Center, China Geological Survey Ma Zhixin, Chengdu Center, China Geological Survey Sun Zhiming, Chengdu Center, China Geological Survey Huang Teng, Geologic Team 605 of Sichuan Metallurgic Bureau Ren Jingwei, Chengdu University of Technology Jiang Yan, Geologic Team 605 of Sichuan Metallurgic Bureau
Data acquision time	2016—2018
Geographic area	North Sichuan (Nanjiang county)
Data format	*.xlsx
Data size	TC51 fixed carbon analysis results of crystalline basement graphite deposit in north of upper Yangtze, data size: 14kb TC51 oxide analysis results of crystalline basement graphite deposit in north of upper Yangtze, data size: 32kb
Data service system URL	http://dcc.cgs.gov.cn
Fund project	China Geology Survey project "Geological Mineral Survey in Tongan–Ninglang, Longmen Mountain–Central Yunnan Metallogenic Zone" (DD20160017)
Language	Chinese
Database(dataset) composition	The dataset consists of 2 Excel sheets titled as "TC51 fixed carbon analysis result sheet of crystalline basement graphite deposit on the northern margin of upper Yangtze" and "TC51 oxide analysis result sheet of crystalline basement graphite deposit on the northern margin of upper Yangtze".

2 Method for Data Acquisition and Processing

2.1 Sampling

In the process of geological mapping, graphite ore was found in a chance encounter in an "exploratory trench" excavated during the erection of HV transmission cables at Daba. Seven samples were taken there, and sample features are shown in Table 2. Samples are laid out in sections on the basis of mineralization strength of the graphite, rock fragmentation and features of hydrothermal solution activity. Total graphite mineralization is controlled in a width of 6.70 m and it extends over 200 m along the strike before it is covered by soil. The host rock is fine-grained quartzite which contains mainly quartz, and then graphite, mica, pyrite and hematite. The rock has strong cleavage in localized places, quartz stringers are developed and then the graphite content is much higher (see Fig. 2A and B).

Table 2 Sample features

Sample no.	Rock and ore name	Sample length (m)	Content of fixed carbon (%)
H1	Banded graphite-mineralized quartzite	1.00	4.34
H2	Cataclastic graphite-mineralized quartzite	1.00	9.44
H3	Graphite-mineralized quartzite	1.50	3.70

Continued table 2

Sample no.	Rock and ore name	Sample length (m)	Content of fixed carbon (%)
H4	Graphite-mineralized quartzite	1.40	4.05
H5	Silicified graphite-mineralized quartzite	1.00	7.79
H6	Graphite-mineralized quartzite	0.80	2.02
H7	Black quartzite	1.00	0.995

2.2 Test Method

Samples were tested by Southwest Metallurgic Geological Test Center, and fixed carbon was tested in a tubular burner; tests were in accordance with DZG 20-02-1991 *Rock and Ore Analysis*. Oxides were tested using a plasma spectrometer Vista-MPX, X-ray spectrometer DY938, tubular burner, electronic balance CP124S, Atomic absorption spectral-photometer Z-2000 and burette, etc.

In test samples, fixed carbon was determined with non-aqueous titration DZG-02-1991. Test samples were treated with nitric acid at high temperature to remove carbonate and organic carbon, then burned at high temperature in oxygen flow; the generated CO_2 was absorbed by an absorption solution, and the fixed carbon content was determined using thymolphthalein as indicator and titrating with potassium ethylate standard solution.

3 Description of Data Samples

The Crystalline-Basement Crystalline Graphite Deposit Dataset on the Northern Margin of the Upper Yangtze and North Sichuan comprises mainly: crystalline basement and fold basement distribution, distribution of main graphite deposits (ore points), sampling locations, TC51 fixed carbon analysis result sheet of crystalline basement graphite deposit on the northern margin of the upper Yangtze, and TC51 oxide analysis result sheet of the same location.

The "TC51 fixed carbon analysis result sheet of crystalline basement graphite deposit on the northern margin of upper Yangtze" (Table 3) contains: sample number, analysis number, sample length (m) and fixed carbon content (%).

Table 3 TC51 fixed carbon analysis result sheet

No.	Field name	Dimension	Data category	Real example
1	Sample no.	None	Character string	TC51-H1
2	Analysis No.	None	Character string	A171960115
3	Fixed carbon	%	Floating-point type	4.34

The "TC51 oxide analysis result sheet of crystalline basement graphite deposit on the northern margin of upper Yangtze" (Table 4) contains: sample number, analysis number, length (m) and 19 test items including SiO_2, Al_2O_3, Fe_2O_3, TFe, FeO, CaO, MgO, K_2O, Na_2O, TiO_2, P_2O_5, S, H_2O^+, H_2O^-, V_2O_5, CO_2, Cu, ash and volatiles, etc.

Table 4 TC51 oxide analysis result sheet

No.	Field name	Dimension	Data category	Real example
1	Sample no.	None	Character string	TC51-H1
2	Analysis No.	None	Character string	A174340098
3	SiO_2	%	Floating-point type	84.97
4	Al_2O_3	%	Floating-point type	2.82
5	Fe_2O_3	%	Floating-point type	2.04
6	TFe	%	Floating-point type	2.25
7	FeO	%	Floating-point type	1.06
8	CaO	%	Floating-point type	0.780
9	MgO	%	Floating-point type	0.640
10	K_2O	%	Floating-point type	0.796
11	Na_2O	%	Floating-point type	0.057
12	TiO_2	%	Floating-point type	0.137
13	P_2O_5	%	Floating-point type	0.616
14	S	%	Floating-point type	0.049
15	H_2O^+	%	Floating-point type	0.924
16	H_2O^-	%	Floating-point type	0.403
17	V_2O_5	%	Floating-point type	0.007
18	CO_2	%	Floating-point type	0.265
19	Cu	%	Floating-point type	0.019
20	ash	%	Floating-point type	94.11
21	volatiles	%	Floating-point type	2.16

4 Data Quality Control and Assessment

The project has been implemented in accordance with the *Guidance to 1：50 000 Mineral Geological Survey* published in August 2015 by CGS. Samples in the field were positioned using the digital geological survey system (DGSS). At mineralized points discovered, exploratory trenches were excavated for recording and grooved for sampling. All samples obtained were delivered to Southwest Metallurgic Geologic Test Center for processing and analysis, and all samples were found acceptable through internal inspection. Samples of graphite ores are small in total quantity, and so were not inspected by any outside institutions.

5 Data Value

This dataset contains the original data of the crystalline graphite deposits discovered in the Houhe Group-complex Wangjiaping Formation quartzite in the crystalline basement on the northern margin of the upper Yangtze landmass for the first time. It enriches the metallogenic types of graphite deposits, extends the era of graphite metallogenesis and provides a new data specimen for theoretical research concerning graphite deposits. Meanwhile, since newly discovered ore-bearing strata are widely distributed on the northern margin and periphery of the upper Yangtze, this dataset opens up new orientation and deployment thinking for graphite prospecting in the area and provides powerful support to further breakthroughs in prospecting and full poverty alleviation in Tongjiang, Nanjiang and Bazhong.

6 Conclusions

1. Through route tracing, profile measurement, grooving and sampling, and rock ore testing, the Daba graphite deposit was surveyed in detail and good mineralization features were found. The mineral body extends 200 m, is 6.70 m wide in outcrop, 4.9 m in average thickness and 5.13% in average grade. Based on the typical deposit model built on the Pinghe graphite deposit in the area, the resource potential of the Daba graphite deposit is predicted using the geological volumetric method with a predicted resource of 1 738 000 tons within 12 km^2 around it.

2. The Daba Houhe Group-complex Wangjiaping Formation graphite is the first graphite deposit discovered in the crystalline basement in the area, which brings new thinking and prospecting orientation to graphite prospecting in north Sichuan, even for the whole northern margin of the upper Yangtze.

3. The extra-large crystalline graphite base in Bazhong, Sichuan, is one of six main graphite resource bases determined in national Mineral Resource Planning (2016—2020). At present, the Bazhong government is making great efforts to build it, and discovery of new types of graphite deposits brings new resource potential for this.

4. After the project, under the guidance of the Bazhong government, social capital is active and optimistic in prospecting for graphite in the metallogenic zone, which is contributing to further employment and economic growth in the poverty area of Tongjiang–Nanjiang–Bazhong, and to precision poverty alleviation in the old revolutionary base areas.

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