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湖北省蒲圻县 (赤壁) 幅 1∶50 000 环境地质调查数据集

张傲　邵长生　王岑　杨艳林　路韬

(中国地质调查局武汉地质调查中心，湖北 武汉 430205)

摘要：依托自然资源部中国地质调查局部署的“长江中游城市群咸宁—岳阳和南昌—怀化段高铁沿线 1∶50 000 环境地质调查”项目，开展了蒲圻县幅 1∶50 000 环境地质调查。本数据集采取水文地质调查、岩溶地面塌陷调查、水文地质钻探、水质测试分析等方法而形成。数据集包含 73 个泉水调查点、7 个矿泉水测试分析结果、1 个岩溶地面塌陷点、7 个岩溶洞穴点、10 个水文钻孔等 5 方面数据。其中泉水调查成果包括泉点的分布位置、野外水质检测指标、泉水成因等；矿泉水分析结果为针对区内泉点及水文钻孔所取水样进行室内测试，达到矿泉水标准的测试结果；岩溶地面塌陷数据主要包括岩溶地面塌陷的位置、塌陷坑特征、地质背景、塌陷后状态等信息；岩溶洞穴调查成果包括洞穴点的位置、洞穴发育特征、开发利用情况等信息；钻孔基本情况数据为钻孔位置信息、孔径、孔深等信息。数据集为赤壁市城镇规划建设，土地安全利用，优质地质资源开发提供重要的地质数据源支撑。

关键词：环境地质调查工程；地下水；矿泉水；岩溶地面塌陷；地质灾害；赤壁市；湖北省

数据服务系统网址：http://dcc.cgs.gov.cn

1　引言

蒲圻县现更名为赤壁市，行政区划隶属于湖北省咸宁市，位于湖北省东南部，陆水河中游南岸，幕阜低山丘陵与江汉平原的过渡地带，其西南与湖南临湘市交界，东与咸宁市接壤，南为崇阳县，北与嘉鱼县相连，西北隔长江与洪湖相望。

蒲圻县 (赤壁) 幅 (H49E014024) 为长江中游城市群咸宁—岳阳和南昌—怀化段高铁沿线 1∶50 000 环境地质调查项目 2017 年工作图幅之一，地理坐标为东经 113°45′～114°00′、北纬 29°40′～29°50′，总面积 450 km^2，测区涉及中伙铺镇、车埠镇、赤壁中心城区等，见图 1。区内地貌以中低山、丘陵岗地、冲洪积平原为主，属亚热带海洋性季风气候，

第一作者简介：张傲，男，1988 年生，博士，工程师，研究方向为城市地质调查；E-mail：zhangaocug@163.com。

多年平均降雨量约为 1 577.4 mm。区内地表水资源丰富，河流沟渠纵横交错，堰塘水库星罗棋布，陆水河为区内主干水系，分布于区中西部，主流方向总体为北西，发源于通城县黄龙山一带的幕阜山，流经通城、崇阳，横贯赤壁全境，由嘉鱼陆溪口入长江。测区区域上位于雪峰地盾、江汉坳陷区及扬子台褶皱带的交汇处，跨新华夏系第二构造沉降带的东部边缘，区内主要发育古生代和中生代地层，除泥盆纪外，从奥陶纪至侏罗纪地层均有出露。第四纪沉积物分布广泛，成因类型复杂多样。

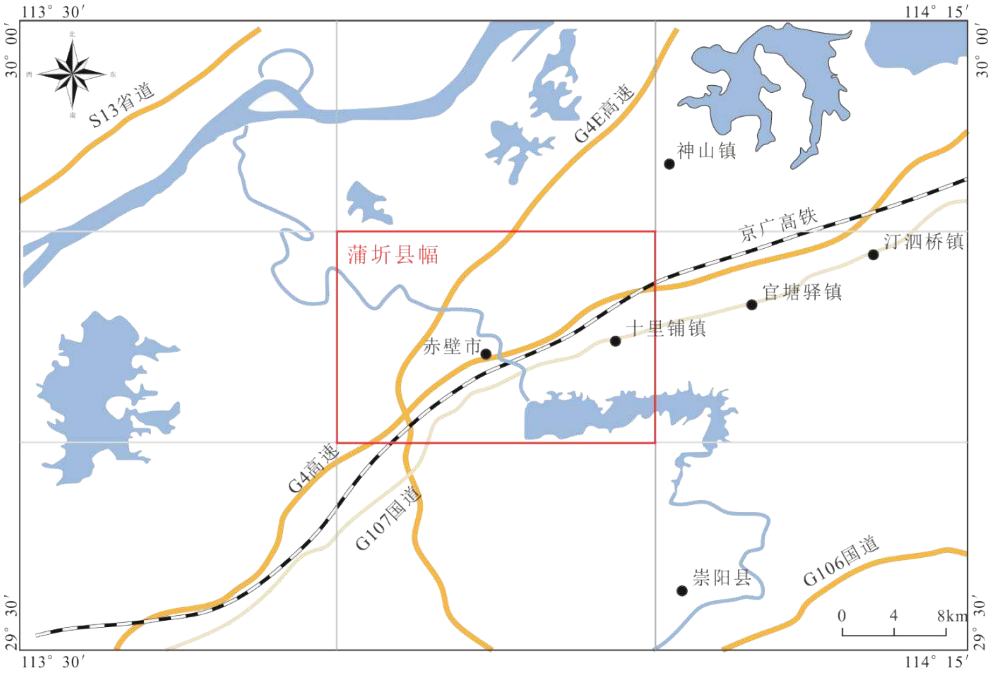

图 1　蒲圻县（赤壁）幅地理交通位置图

1966 年，湖北省区调所开展了 1∶200 000 蒲圻幅区域地质普查；1976 年，湖北省水文地质大队开展了 1∶200 000 蒲圻幅区域水文地质普查，1979 年，又开展了供水水文地质勘察工作；2005 年，湖北省地质环境总站完成了湖北省赤壁市地质灾害调查与区划工作；通过对赤壁市城区生活饮用水水质监测分析表明陆水水库水体受到了有机物污染 (付立新，2012)。上述工作及研究基本查明了区内的地质环境条件，但由于工作目的及精度要求不同，对关键的环境地质问题数据调查深度及广度不足。本数据集采集的岩溶地面塌陷点、实施的水文地质钻孔，为岩溶地面塌陷易发性分区与评价奠定了基础，进而为赤壁市城镇规划建设、土地安全利用提供了地质依据；采集的各类泉点、岩溶洞穴反映了赤壁市潜在丰富的地质资源，对赤壁市优质地质资源开发具有重要意义，数据集基本信息如表 1 所示。

2　数据采集和处理方法

2.1　调查点数据采集

本次调查以《环境地质调查技术要求 (1∶50 000)》(DD 2019−07)、《水文地质调查规范 (1∶50 000)》(DZT 0282−2015)、《岩溶地面塌陷调查规范 1∶50 000 送审稿》为依据，岩溶地面塌陷调查与水文地质调查同时开展，野外手图采用 1∶25 000 地形图，以穿越法为主，以追索法为辅。编制了地面调查技术细则，每个点位记录按分类要

表 1　数据库 (集) 元数据简表

条目	描述
数据库(集)名称	湖北蒲圻县(赤壁)幅1：50 000环境地质调查数据集
数据库(集)作者	张傲，中国地质调查局武汉地质调查中心 邵长生，中国地质调查局武汉地质调查中心 王岑，中国地质调查局武汉地质调查中心 杨艳林，中国地质调查局武汉地质调查中心 路韬，中国地质调查局武汉地质调查中心
数据时间范围	2017.1—2017.12
地理区域	湖北省咸宁市赤壁
数据格式	*.xlsx
数据量	76 KB
数据服务系统网址	http://dcc.cgs.gov.cn
基金项目	武汉市多要素城市地质调查(DD20190282)和长江中游城市群咸宁−岳阳和南昌−怀化段高铁沿线1：50 000环境地质调查(DD20160248)联合资助
语种	中文
数据库(集)组成	泉水调查表.xlsx、矿泉水测试分析表.xlsx、岩溶地面塌陷调查表.xlsx、岩溶洞穴调查表.xlsx、钻孔基本情况表.xlsx

求逐一填写，统一格式，做到了规范化、系统化作业。调查点主要为岩溶地面塌陷点、井泉、岩溶地貌点 (岩溶洼地、漏斗、天窗等)、岩性岩相变化及重要工程活动点。区内覆盖型岩溶分布区面积为 189.25 km^2，约占 42.1%；裸露型岩溶分布区面积为 64.55 km^2，约占 14.34%；非岩溶区面积为 157.75 km^2，约占 35.1%。覆盖型岩溶于区内分布最为广泛，且时有岩溶地面塌陷发生对人类生产生活造成严重威胁与隐患，因此将覆盖型岩溶分布范围作为重点数据采集区域。

泉水调查采集数据主要包括泉水形成成因、泉水流量，并对泉水进行现场指标测试。泉水流量测量方法主要为流速仪法、容积法、矩形堰法等；水质检测运用 Eureka water probes Manta2 多参数水质分析仪，对调查的 (岩溶) 泉点、地下水 (地下暗河) 的出露点进行现场水分析，获取 pH、电导率、*Eh*、溶解氧、水温等现场指标，同时记录水体颜色、浑浊度、嗅和味、肉眼可见物等指标。

岩溶地面塌陷调查采集数据主要包括发生岩溶地面塌陷的位置、发生与持续时间；塌陷坑深度、平面形态、剖面形态、展布及内部特征，以及塌陷坑周边地裂缝的几何特征，如长度、宽度、数量、延伸方向等。

岩溶洞穴调查采集数据主要包括岩溶洞穴出露位置、成因、形成条件、洞口、内部形态以及洞穴开发利用情况，有岩溶水出露的洞穴点同时采用上述仪器进行现场水质检测。

所有调查点数据均未经处理，皆为现场调查数据采集，各调查点分布如图 2 所示。

2.2　水样采集与样品测试

在前期调查的泉点、岩溶水点及暗河出入口进行野外水样采集，严格依照《生活饮用水标准检验方法水样的采集和保存》(GB/T 5750.2−2006)、《水质采样样品的保存和管理技术规定》(HJ 493−2009)、《水质采样技术指导》(HJ 494−2009) 进行水样采集、保存和送样，共采集全分析 10 组。

依据《饮用天然矿泉水》(GB 8537−2008) 以及《地下水质量标准》(GB/T 14848−

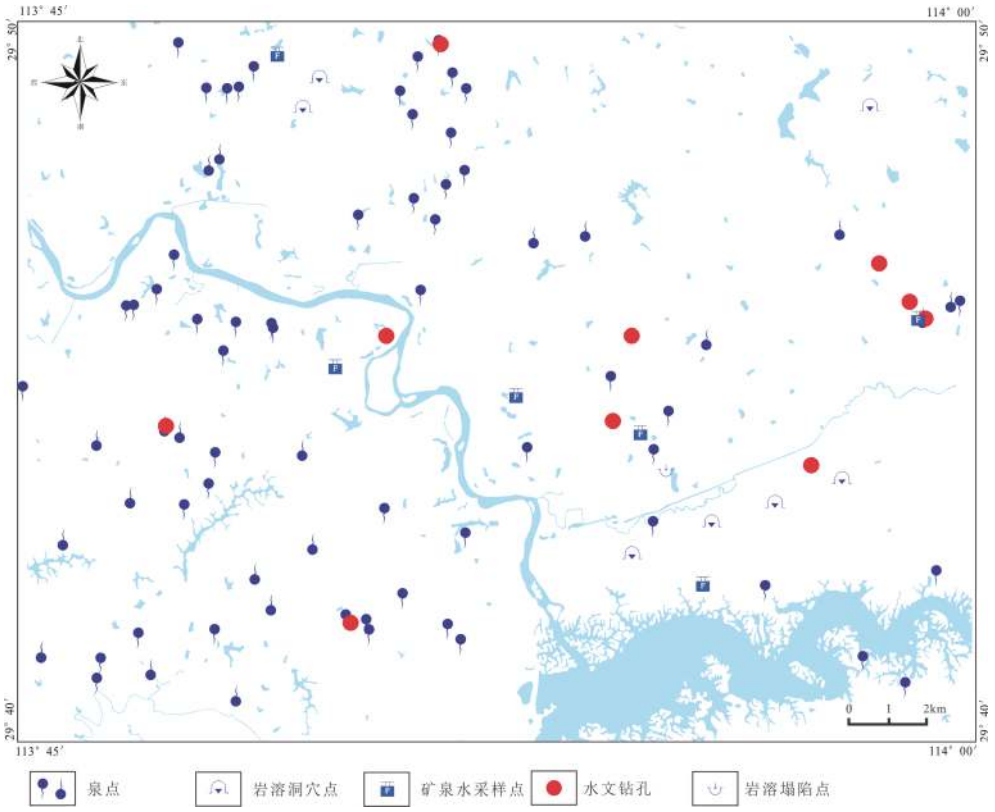

图 2　地下水调查点分布图

2017），选取了水质常规指标、非常规指标，共计 48 项。并参照这些指标的界限值及限量值，对这 10 组水样测试结果进行矿泉水分析与地下水质量评价，共有 7 组水样测试结果达到饮用天然矿泉水标准。

本数据集仅对达到饮用天然矿泉水标准的测试结果进行汇总。

2.3　钻孔数据采集

本次钻探施工均为水文地质钻孔，依据《水文地质调查规范 (1∶50 000)》(DZ/T 0282−2015)、《水文水井地质钻探规程》(DZ/T 0148−2014) 编制了覆盖型岩溶区水文地质钻探施工技术要求，钻探施工及数据记录均严格按照操作规程进行。

本数据集对实施的水文地质钻孔进行集成整理，形成了钻孔基本信息表。所有钻孔在钻进过程中均做了简易水文地质观测，观测孔内水位、水温变化。钻孔的静止水位及初见水位埋深采用 Solinst Water Level Meter Model 101 水位尺进行测量，水温数据采用水银温度计。

所有钻孔均采集水样并送至实验室进行水质检测，其中 SZK1、SK2、SZK5、SZK6、SZK7 进行矿泉水分析，SZK3、SK4、SZK8、SZK9、SZK10 进行水质全分析。

3　数据样本描述

湖北蒲圻县 (赤壁) 幅 1∶50 000 环境地质调查数据集为 Excel 表格型数据，包括 5 个文件，分别为泉水调查表.xlsx、矿泉水测试分析表.xlsx、岩溶地面塌陷调查表.xlsx、岩溶洞穴调查表.xlsx 和钻孔基本情况表.xlsx。

泉水调查表.xlsx 数据文件 (表 2) 描述含野外编号、地理位置、图幅编号、泉水类

表 2　泉水调查表

序号	数据项名称	数据类型	实例
1	野外编号	字符串	Q120
2	地理位置	字符串	赤壁市凤凰山镇公安泉村八组
3	图幅编号	字符串	蒲圻县幅(H49E014024)
4	泉水类型	字符串	下降泉
5	含水层岩性	字符串	S2f2泥质粉砂岩夹砂岩
6	主要用途	字符串	未利用
7	补给来源	字符串	碎屑岩裂隙水
8	天气	字符串	多云转晴
9	气温/℃	浮点型	33
10	流量测定方法	字符串	流速仪
11	泉的流量/(L/s)	浮点型	0.16
12	动态变化特征	字符串	据访问，该泉流量随季节变化，长年有水，雨后流量增大，枯季减少
13	泉水温度/℃	浮点型	18
14	色度	字符串	无
15	味	字符串	无
16	气味	字符串	无
17	透明度	字符串	透明
18	pH	浮点型	7.06
19	取样情况	字符串	无
20	*Eh*/mV	浮点型	257
21	*DO*/(mg/L)	浮点型	6.12
22	电导率/(μs/cm)	浮点型	267.1
23	周围可能的污染源	字符串	周围未见明显污染源
24	含水层特征	字符串	地质：为志留系坟头组泥质粉砂岩。地貌：位于低岗地与堆积阶地过渡地带。含水层：点西侧为志留系坟头组碎屑岩裂隙含水岩组，富水性中等，据调查，该泉原供应生产队几十人同时使用
25	备注	字符串	据访问，该泉原来流量较大，流量可达0.3 L/S。因废弃多年无人使用，致使先流量很小。点位于王洪山背斜北翼
26	调查工作时间	字符串	2017-06-03

型、含水层岩性、主要用途、补给来源、天气、气温、流量测定方法、泉的流量、动态变化特征、泉水温度、色度、味、气味、透明度、pH、取样情况、*Eh*、耗氧量 (*DO*)、电导率、周围可能污染源、含水层特征、备注、调查工作时间等信息。

矿泉水测试分析表.xlsx 数据文件（表 3）为达到矿泉水标准的 7 组水样测试结果，每 1 组测试结果为 1 行，包含送样号、分析号及测试指标 HBO_2、Cu、Pb、Zn、Ni、Co、Cd、Li、Mo、As、Hg、Sr、Ba、V、Se、Ag、I^-、K^+、Na^+、Ca^{2+}、Mg^{2+}、NH^{4+}、Fe^{3+}、Fe^{2+}、Cl^-、SO_4^{2-}、HCO_3^-、CO_3^{2-}、NO_3^-、NO_2^-、F^-、PO_4^{3-}、pH、H_2SiO_3、Mn、Br^-、耗氧量、游离 CO_2、可溶性 SiO_2、Cr^{6+}、Al^{3+}。

岩溶地面塌陷调查表.xlsx 数据文件 (表 4) 包含塌陷点野外编号、图幅编号、天气、地理位置、塌陷前兆、诱发因素、塌陷坑深度、塌陷坑剖面形态、塌陷坑平面形态、下

表 3　矿泉水测试分析表

序号	数据项名称	数据类型	实例	序号	数据项名称	数据类型	实例
1	送样号	字符串	Q02	23	Mg^{2+}/(mg/L)	浮点型	4.14
2	分析号	字符串	C172070002	24	NH^{4+}/(mg/L)	浮点型	0
3	HBO_2/(mg/L)	浮点型	0.012	25	Fe^{3+}/(mg/L)	浮点型	0.046
4	Cu/(mg/L)	浮点型	0.001 0	26	Fe^{2+}/(mg/L)	浮点型	0
5	Pb/(mg/L)	浮点型	0.000 30	27	Cl^{-}/(mg/L)	浮点型	1.67
6	Zn/(mg/L)	浮点型	0.001 1	28	SO_4^{2-}/(mg/L)	浮点型	19.3
7	Ni/(mg/L)	浮点型	0.007 8	29	HCO^{3-}/(mg/L)	浮点型	266
8	Co/(mg/L)	浮点型	0.001 4	30	CO_3^{2-}/(mg/L)	浮点型	0
9	Cd/(mg/L)	浮点型	<0.000 1	31	NO_3^{-}/(mg/L)	浮点型	11.4
10	Li/(mg/L)	浮点型	0.003 0	32	NO_2^{-}/(mg/L)	浮点型	0
11	Mo/(mg/L)	浮点型	0.000 20	33	F^{-}/(mg/L)	浮点型	0.19
12	As/(mg/L)	浮点型	0.003 0	34	PO_4^{3-}/(mg/L)	浮点型	0.022
13	Hg/(mg/L)	浮点型	0.000 10	35	pH	浮点型	7.6
14	Sr/(mg/L)	浮点型	0.36	36	H_2SiO_3/(mg/L)	浮点型	11.8
15	Ba/(mg/L)	浮点型	0.016	37	Mn/(mg/L)	浮点型	0.004 1
16	V/(mg/L)	浮点型	0.001 7	38	Br^{-}/(mg/L)	浮点型	0.009 0
17	Se/(mg/L)	浮点型	0.000 30	39	耗氧量/(mg/L)	浮点型	0.64
18	Ag/(mg/L)	浮点型	0.000 20	40	游离CO_2/(mg/L)	浮点型	3.30
19	I^{-}/(mg/L)	浮点型	0.001 0	41	可溶性SiO_2/(mg/L)	浮点型	9.10
20	K^{+}/(mg/L)	浮点型	0.37	42	Cr^{6+}/(mg/L)	浮点型	0
21	Na^{+}/(mg/L)	浮点型	0.90	43	Al^{3+}/(mg/L)	浮点型	0.068
22	Ca^{2+}/(mg/L)	浮点型	91.4				

伏基岩是否可见、水位埋深、塌陷坑长轴方向、有无洞穴存在、江河水位高程、塌陷坑短轴半径、洞穴类型、地貌类型、土地利用类型、附近最近出现的塌坑或湖、土层结构、土层厚度、基岩层位、基岩岩性、是否已处理、处理方案、群体分布情况、调查日期等信息。

岩溶洞穴调查表.xlsx 数据文件 (表 5) 包含洞穴调查点野外编号、图幅编号、地理位置、天气、温度、洞口高、洞口宽、洞口形状、洞口朝向、样品及数量、地貌类型、洞穴利用、地貌位置、地层及岩性、构造部位、水文地质、工程地质、洞穴描述、备注、调查日期等信息。

钻孔基本情况表.xlsx 数据文件 (表 6) 包含野外编号、地理位置、图幅编号、孔口高程、钻机类型、钻孔类型、开孔日期、终孔日期、井斜、开孔直径、终孔直径、终孔深度、含水层初见水位、成井深度、静止水位、含水层特征、调查日期等信息。

4　数据质量控制和评估

4.1　调查点数据质量

各类调查点的质量控制以《环境地质调查技术要求 (1∶50 000)》(DD 2019−07)、《水文地质调查规范 (1∶50 000)》(DZT 0282−2015)、《岩溶地面塌陷调查规范 1∶

表 4　岩溶地面塌陷调查表

序号	数据项名称	数据类型	实例
1	野外编号	字符串	TX446
2	图幅编号	字符串	蒲圻县幅(H49E014024)
3	天气	字符串	晴
4	地理位置	字符串	湖北省赤壁市赤马港镇砂子岭村八组
5	塌陷前兆	字符串	地面裂缝
6	诱发因素	字符串	道路施工，抽水，地面堆载
7	塌陷坑深度	浮点型	3
8	塌陷坑剖面形态	字符串	坛状
9	塌陷坑平面形态	字符串	椭圆形
10	下伏基岩是否可见	字符串	否
11	水位埋深/m	浮点型	4.88
12	塌陷坑长轴方向	浮点型	10
13	有无洞穴存在	字符串	无
14	江河水位高程/m	浮点型	29.9
15	塌陷坑长轴半径/m	浮点型	57.5
16	塌陷坑短轴半径/m	浮点型	35
17	洞穴类型	字符串	土洞
18	地貌类型	字符串	丘陵平原
19	土地利用类型	字符串	旱地
20	附近最近出现的塌坑或湖	字符串	无
21	土层结构	字符串	单层结构Qp棕红色网纹状粉质黏土，密集坚硬
22	土层厚度/m	浮点型	5
23	基岩层位	字符串	三叠系下统嘉陵江组T*j*
24	基岩岩性	字符串	白云质灰岩、灰岩
25	是否已处理	字符串	是
26	处理方案	字符串	1号塌陷坑于2010年采用跨越式基础应急措施，目前为平地建成河北大道路面，塌陷区未见明显变形，处理措施效果较好；2号塌陷坑于2012年采用填土夯实措施，现已建成地下停车场至今未再发生过塌陷现象
27	群体分布情况	字符串	距1号塌坑SE方向86 m处菜地发生2号塌坑
28	调查日期	字符串	2017-06-19

50 000 》(送审稿）为标准，调查点的坐标使用手持 GPS 北京 54 坐标系统读数、地物信息与地形图图面信息三者对应。调查点数据的整理包括野外现场填写检查、室内审核以及数据库录入核查，并按照三级管理体系要求进行检查，执行自检、互检、抽检制度。

4.2　水样测试数据质量

采集水样委托国土资源部长沙矿产资源监督检测中心 (湖南省地质测试研究院) 进行测试，具备国家检测资质。

样品测试的准确度控制采用插入标准溶液样和加标回收两种方法进行。单个统计标准溶液样的测量值在其给定参考值的 2 倍不确定范围内为合格。加标回收率在 90% ~

表 5　岩溶洞穴调查表

序号	数据项名称	数据类型	实例
1	野外编号	字符串	DX422
2	图幅编号	字符串	蒲圻县幅(H49E014024)
3	地理位置	字符串	湖北省赤壁市赤马港办事处砂子岭社区九组
4	天气	字符串	晴
5	温度/℃	浮点型	27
6	洞口高/m	浮点型	7.2
7	洞口宽/m	浮点型	4.3
8	洞口形状	字符串	拱形
9	洞口朝向/°	字符串	西北向290°
10	样品及数量	字符串	简分析2组(J21)
11	地貌类型	浮点型	岩溶丘陵
12	洞穴利用	浮点型	未利用
13	地貌位置	字符串	低丘中底部
14	地层及岩性	字符串	三叠系下统嘉陵江中段(T_1j^2)灰岩，产状：170°∠65°
15	构造部位	字符串	位于B8蒲圻向斜南翼
16	水文地质	字符串	为碳酸盐岩类岩溶裂隙水，具备良好的地下水运移通道，洞穴内部地表形成水流，顶部有多出渗水点，有水滴落，下大雨水量增大，干旱时水量减少。流速法测得流量Q=193.34 L/S
17	工程地质	字符串	洞口走向110°，基岩裸露，出露地层岩性为三叠系下统嘉陵江组中段(T_2j)灰色灰岩，薄层—中厚层状，溶蚀而光滑，小溶沟溶槽发育，岩层产状179°∠69°，方解石脉发育，较坚硬
18	洞穴描述	字符串	溶穴走向110°，近水平方向延伸，约30 m向左发育(100°)，长逾50 m，洞内宽3～6 m，高5～7 m，石针乳，石灰华发育，水底见砂石冲出物(卵石、细砂)。推测为地下河出口
19	备注	字符串	本次实测：流速法，Q=192.57 L/S；水温T=16.9℃，pH=7.2，Eh=253.0 mV，Ec=446.01 μs/cm，DO=9.01
20	调查日期	字符串	2017-06-14

110% 范围内为合格 (龚磊等，2019)。

水质样品测试的精密度控制采用重复测试的方法进行，每一批次水质样品随机抽取 20% 作为检查测试样，编成密码一同测试。按《地质矿产实验室测试质量管理规范 第 6 部分：水样分析》(DZ/T0130.6 −2006) 标准中水质测试相对偏差允许限 (Y=11.0C·X−0.28) 判断是否合格 (马洪云等，2018)。

4.3　钻孔数据质量

水文地质钻孔数据的质量控制严格按照《水文地质调查规范 (1∶50000)》(DZ/T 0282−2015)、《水文水井地质钻探规程》(DZ/T 0148−2014) 开展水文地质钻探工作。

编制了钻探施工技术要求，分别按回次和分层编录，单孔均进行了质量审核，施工质量合格率为 100%。钻探实施全流程中，为保障钻探数据采集质量，记录了钻孔质量检查表、钻孔质量验收表、钻孔设计书、钻孔基本情况表等一系列钻探资料，钻探资料齐全完整，记录完整，本数据集仅对钻孔基本情况表进行整理。钻孔数、进尺和施工质量均满足规范要求。

表 6　钻孔基本情况表

序号	数据项名称	数据类型	实例
1	野外编号	字符串	SZK2
2	地理位置	字符串	湖北省赤壁市中伙铺镇中伙村十六组
3	图幅编号	字符串	蒲圻县幅(H49E014033)
4	孔口高程/m	浮点型	44
5	钻机类型	字符串	XY-2
6	钻孔类型	字符串	水文钻孔
7	开孔日期	字符串	2017-11-28
8	终孔日期	字符串	2017-12-17
9	井斜/°	浮点型	0.5
10	开孔直径/mm	浮点型	219
11	终孔直径/mm	浮点型	130
12	终孔深度/m	浮点型	152
13	含水层初见水位/m		0.6
14	成井深度/m	浮点型	152
15	静止水位/m	浮点型	0.98
16	含水层特征	字符串	地质：钻孔揭露土层9.00 m为第四系黏土(Qh)，9 ~ 152.00 m为P_1q灰色灰岩。地貌：孔位位于岗地底部，地形起伏较小。含水层：主要含水段为9 ~ 152.00 m，其中孔深21.6 ~ 26.1 m，29.1 ~ 30.40 m为溶洞，含岩溶水，中等富水性
17	调查日期	字符串	2017-12-17

5　数据价值

本数据集涵盖了赤壁城区及周边乡镇基础的地质调查、钻探、测试分析等各类环境地质成果信息，具有广阔的应用前景，体现在以下 3 个方面:

(1) 数据采集的岩溶地面塌陷点、实施的水文地质钻孔，基本查明了赤壁市主要环境地质问题岩溶地面塌陷的分布情况，覆盖型岩溶区的土层结构、厚度以及区内岩溶发育程度，为岩溶地面塌陷易发性分区与评价奠定了基础，进而为赤壁市城镇规划建设、土地安全利用提供地质依据。

(2) 数据采集的各类泉点、岩溶洞穴反映了赤壁市潜在丰富的地质资源，为赤壁市发展地质旅游资源提供了可选目标，此外赤壁市现已有地热资源 (五洪山温泉)、地质遗迹景观 (三国古战场、羊楼洞)，可联动打造多站式精品旅游线路或特色旅游小镇。

(3) 矿泉水样测试结果多数为富锶，含量达到矿泉水标准，特别是赤壁文家山地区，多处泉点串珠分布，泉水及水文钻孔水质检测结果均富锶、水量较大，且地表土壤富锶，锶含量达 2.04 mg/kg(数据来源土壤样微量元素测试结果)，资源种类丰富，资源开发利用潜力大，可作为完善的优质农产品培育基地。

6　结论

湖北蒲圻县 (赤壁) 幅 1：50 000 环境地质调查数据集包括：泉水调查表.xlsx、矿泉水测试分析表.xlsx、岩溶地面塌陷调查表.xlsx、岩溶洞穴调查表.xlsx 和钻孔基本情况表.xlsx。该数据集成果可为赤壁市城镇规划建设、土地安全利用和重大工程建设提供基

础地质数据支撑，对区域优质地质资源的开发利用具有重要参考价值。

致谢：湖北蒲圻县 (赤壁) 幅 1∶50 000 环境地质调查是集地面调查、钻探、测试分析等各类地质方法为一体的综合地质工作，离不开各个环节地质人员的辛勤付出。数据集的录入、整理及分析得到了数据库专家及实验室专家的指导，数据论文修改阶段得到了审稿专家及编辑部的宝贵意见，在此对各位专家和野外项目组所有成员表示最诚挚的感谢。

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Dataset of the Environmental Geological Survey on a Scale of 1∶50 000 in the Puqi County (Present Chibi City) Map Sheet, Hubei Province

ZHANG Ao, SHAO Changsheng, WANG Cen, YANG Yanlin, LU Tao

(*Wuhan Center*, *China Geological Survey*, *Wuhan* 430205, *China*)

Abstract: The environmental geological survey on a scale of 1∶50 000 in the Puqi Map Sheet (also referred to as the Survey) was carried out by relying on the project titled *Environmental Geological Survey on a Scale of 1∶50 000 in the City Clusters of the Middle Reaches of the Yangtze River Along Xianning – Yueyang and Nanchang – Huaihua High-speed Railway* initiated by the China Geological Survey. The dataset obtained through the Survey (also referred to as the Dataset) was developed by methods such as the hydrogeological survey, karst collapse survey, hydrogeological drilling and water-quality testing and analysis. It consists of the data of 73 spring survey points, test and analystical results of mineral water from 7 water samples and the data from 1 karst collapse point, 7 karst cave points and 10 hydrological boreholes. The detailed contents of these data are as follows: the results of the spring water survey include locations of spring survey points, water quality indices to be tested in the field and the genesis of spring water. The analytical results of mineral water are the ones reaching the requirements of mineral water according to the indoor testing of water samples taken from spring points and hydrological boreholes in the Puqi County Map Sheet. The data of karst collapses mainly include location of karst collapses, features of collapse pits, geological background and the state after collapse. The survey results of karst caves include the location, development features and development and utilization of the caves. The data of boreholes contain the location, diameter and depth of the boreholes. The Dataset will provide an important geological source for the planning and construction of towns, safe utilization of land and the development of high-quality geological resources in Chibi City.

Key words: environmental geological survey engineering; groundwater; mineral water; karst collapse; geologic disaster; Chibi City; Hubei Province

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

About the first author: ZHANG Ao, male, born in 1988, engineer with doctorate degree, engages in urban geological survey; E-mail: zhangaocug@163.com.

1 Introduction

Puqi County, now renamed Chibi City, is affiliated to Xianning City, in Hubei Province administratively and located in the southeastern part of the province. It lies on the southern bank of the middle reaches of the Lushui River and the transitional zone between the Mufu low-mountainous and hilly area and the Jianghan Plain. It borders Linxiang City, Hunan Province in the southwest, Xianning City in the east, Chongyang County in the south and Jiayu County in the north. Furthermore, it is separated from Hong Lake by the Yangtze River in the northwest.

The Puqi Map Sheet (H49E014024) is one of the map sheets surveyed in the project *Environmental Geological Survey on a Scale of 1∶50 000 in the City Clusters of the Middle Reaches of the Yangtze River Along Xianning – Yueyang and Nanchang – Huaihua High-speed Railway* in 2017. It is located at E 113°45′–114°00′ and N 29°40′–29°50′, with a total area of 450 km^2. The areas involved in the survey include Zhonghuopu Town, Chebu Town and the central urban area of Chibi City, as shown in Fig. 1. The low–medium mountains, hills, downland and alluvial-proluvial plain are mainly distributed in the map sheet. It features a subtropical marine monsoon climate, with an average annual precipitation of about 1 577.4 mm. The map sheet boasts rich surface water resources since multiple rivers and ditches cross each other and it is dotted with weir-related ponds and reservoirs. The Lushui River, as the main water system in the map sheet, is distributed in the central and western parts and generally flows from southeast to northwest. It originates from the Mufu Mountain in the Huanglong Mountain area, Tongcheng County and flows into the Changhe River at Luxikou Town, Jiayu County through Tongcheng County, Chongyang County and the whole Chibi City. Regionally, the map sheet is situated at the intersection of the Xuefeng Shield, the Jianghan Depression area and the fold zone of the Yangtze Platform and spans the east margin

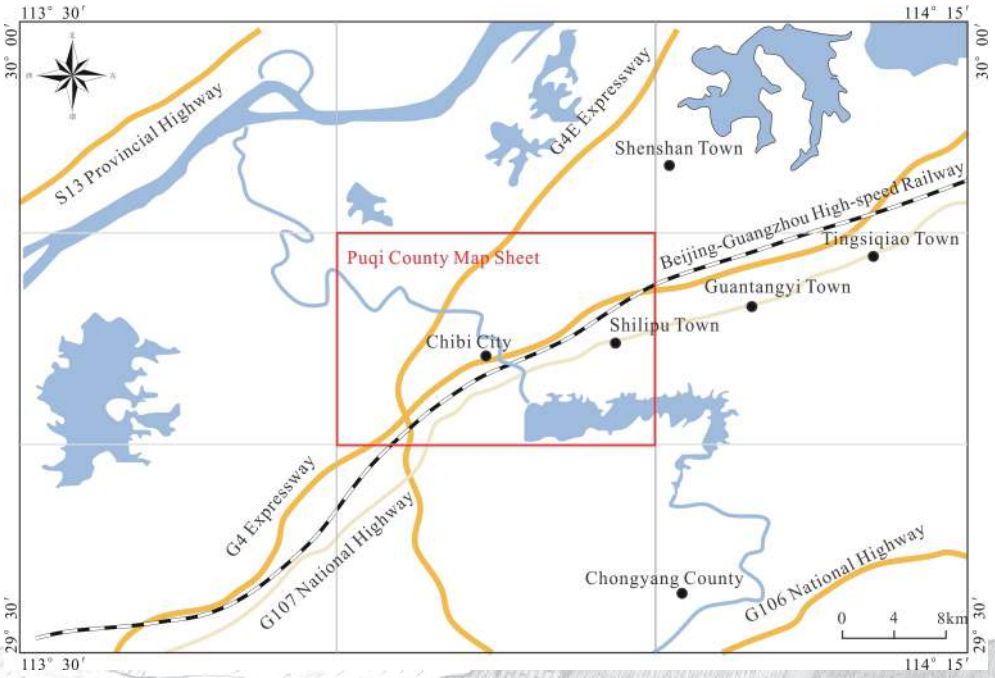

Fig. 1 Geographic Location Map of the Puqi County Map Sheet

of the second tectonic subsidence zone of the New Cathaysian System. Paleozoic and Mesozoic strata are mainly developed in the map sheet and the outcrops include the strata from Ordovician to Jurassic except for Devonian. A variety of Quaternary sediments and complex genesis are widely distributed.

In 1966, the Hubei Institute of Regional Geology and Mineral Resources Survey conducted a regional geological survey on a scale of 1∶200 000 in the Puqi County Map Sheet. In 1976, the Hubei Institute of Hydrogeological and Engineering Geological Investigation carried out a regional hydrogeological reconnaissance survey on a scale of 1∶200 000 in the Puqi County Map Sheet and in 1979, it performed a hydrogeological investigation of the water supply in the map sheet. In 2005, the Hubei Geological Environmental Station conducted a survey of geological disasters in Chibi City and determined geological-disaster-based zones. In the same year, it was indicated from the monitoring and analysis of drinking water quality in the urban area of Chibi City conducted by Fu Lixin that the water in the Lushui Reservoir suffered from organic pollution (Fu LX, 2012). Through the surveys and studies mentioned above, the geological environmental conditions in the Puqi County Map Sheet were ascertained. However, these surveys are too insufficient in breadth and depth to obtain the data of any major environmental geological problems owing to their goals and precision requirement. During the development of this Dataset, the data of karst collapse points were collected and hydrogeological boreholes were drilled, providing a foundation for zoning and an assessment of karst collapses and further providing geological basis for the planning and construction of towns in Chibi City. Furthermore, the data of various spring points and karst caves in the Dataset reflect that there are potential-rich geological resources in Chibi City, which is significant for the development of high-quality geological resources in the city. The basic information on the Dataset is shown in Table 1.

2 Methods for Data Acquisition and Processing

2.1 Data Acquisition of Survey Points

The Survey was performed in accordance with *Technical Requirement for Environmental Geological Survey* (1∶50 000) (DD 2019–07), *Specifications for Hydrogeological Survey* (1∶50 000) (DZ/T 0282–2015) and *Standard Guide for Karst Collapse Investigation* (1∶50 000) (the version for approval). During the Survey, the karst collapse survey and the hydrogeological survey were conducted concurrently. The topographical maps on a scale of 1∶25 000 were adopted as freehand field maps, which were mainly mapped by a traverse method assisted by a tracing method during the Survey. As for the ground survey, detailed technical rules were prepared and the positions of all survey points were gradually recorded, according to the categories of the points, in a unified format. Thereby ensuring that the ground survey was conducted in a standardized and systematical manner. The survey points mainly include karst collapse points, wells, springs, points of karst landform (including depression, funnel and skylight), the points with changes in lithology and lithofacies and important engineering activity points. The respective distribution area of covered karst, bear karst and

Table 1 Metadata Table of Database (Dataset)

Items	Description
Database (dataset) name	Dataset of the Environmental Geological Survey on a Scale of 1∶50 000 in the Puqi County (Present Chibi City) Map Sheet, Hubei Province
Database (dataset) authors	Zhao Ao, Wuhan Center, China Geological Survey Shao Changsheng, Wuhan Center, China Geological Survey Wang Cen, Wuhan Center, China Geological Survey Yang Yanlin, Wuhan Center, China Geological Survey Lu Tao, Wuhan Center, China Geological Survey
Data acquisition time	January—December in 2017
Geographic area	Chibi City, Xianning, Hubei Province
Data format	*.xlsx
Data size	76 KB
Data service system URL	http://dcc.cgs.gov.cn
Fund project	Jointly funded by two projects titled "Multi-element Urban Geological Survey of Wuhan City" (DD20190282) and "Environmental Geological Survey on a Scale of 1∶50 000 in the City Clusters of the Middle Reaches of the Yangtze River Along Xianning – Yueyang and Nanchang – Huaihua High-speed Railway" (DD20160248).
Language	Chinese
Database (dataset) composition	Spring water survey.xlsx, Mineral water testing and analysis.xlsx, Karst collapse survey.xlsx, Karst cave survey.xlsx, and Basic information of boreholes.xlsx

non-karst area is 189.25 km^2, 64.55 km^2, and 157.75 km^2, respectively accounting for 42.1%, 14.34% and 35.1% of the total area of the Puqi County Map Sheet. It can be seen that the covered karst is the most widely distributed. Considering that karst collapse irregularly poses heavy threats and risks to human reproduction and living in the map sheet, the covered karst area is considered as a key area for data acquisition in this survey.

For the survey of spring water, the genesis and flow of spring water were mainly acquired and on-site indices of spring water were tested in the field. Velocity meters, volumetric method and rectangular weirs were mainly adopted to gauge the water flow and multi-parameter water-quality analyzers, Eureka Water Probes Manta2, were used to test the water quality. On-site water analysis was conducted for (karst) spring points surveyed and groundwater (underground river) outcrops. As a result, the indices such as pH, electrical conductivity (*EC*), oxidation-reduction potential (*Eh*), dissolved oxygen (*DO*) and water temperature were obtained, and additionally, the indices including color, turbidity, odor, taste and visible impurities were recorded.

As for the karst collapse survey, the data acquired mainly include location, date and duration of karst collapse; the depth, morphology of planes and profiles, distribution and internal features of collapse pits; and geometrical features of fissures surrounding the collapse pits such as length, width, quantity and extending direction.

And for the karst cave survey, the data acquired mainly include outcrop location, genesis, formation conditions, morphology of the opening and inside and the status quo of development and utilization of the caves. Furthermore, as for the karst caves with karst water outcrops, the

water quality was tested on-site with the aforementioned instruments.

The data of all survey points were not processed and were all collected on-site instead. The survey points are distributed as shown in Fig. 2.

2.2 Collection and Testing of Water Samples

Water samples were collected from the spring points, karst water points and inlets and outlets of underground rivers that were previously surveyed. They were taken, preserved and presented for tests in accordance with *Standard Examination Methods for Drinking Water – Collection and Preservation of Water Sample* (GB/T 5750.2–2006), *Water Quality Sampling – Technical Regulation of Preservation and Handling of Samples* (HJ 493–2009), and *Water Quality – Guidance on Sampling Techniques* (HJ 494–2009), with a total of 10 water samples collected for complete chemical analysis.

48 regular and non-regular indices for water quality testing were selected in accordance with *Drinking Natural Mineral Water* (GB 8537–2008) and *Standard for Groundwater Quality* (GB/T 14848–2017). Furthermore, by referencing the thresholds and limits of these indices specified in the two standards, mineral water analysis and groundwater quality assessment were conducted based on the test results of the 10 water samples. As a result, the test results of 7 water samples reach the standards of natural mineral drinking water.

In this Dataset, only the test results that reach the standards of natural mineral drinking water were summarized.

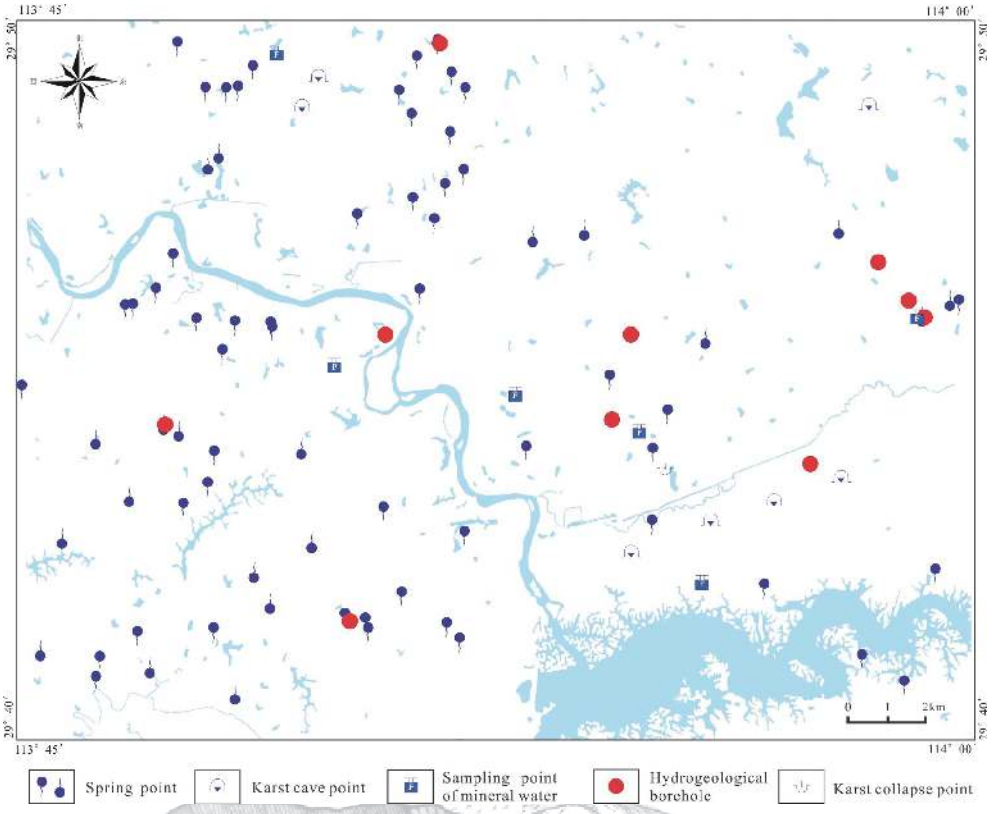

Fig. 2 Distribution of the Groundwater survey points

2.3 Data Acquisition of Boreholes

All boreholes drilled during the Survey were for hydrogeological investigation. The technical requirements of hydrogeological drilling and construction in the covered karst area were prepared according to *Specification for Hydrogeological Survey* (1∶50 000) (DZ/T 0282–2015) and *Specification for Hydrological Well Drilling* (DZ/T 0148–2014). Drilling and construction and also data recording in the Survey were all conducted in strict accordance with the operational procedures specified by the technical requirements.

The "Basic information of boreholes.xlsx" was formed based on the integration and collation of the boreholes. Simple hydrogeological observation of the change in water level and temperature was carried out during the drilling of all the boreholes. The static and initial water level in the boreholes were determined with a water gauge, Solinst Water Level Meter Model 101, and the water temperature was measured with mercury-in-glass thermometers.

Water sampling was taken in all the boreholes and the samples were presented to labs for water quality testing. Mineral water analysis was conducted on the samples collected from boreholes SZK1, SK2, SZK5, SZK6 and SZK7, while a complete chemical analysis of the water quality was performed on the samples taken from boreholes SZK3, SK4, SZK8, SZK9 and SZK10.

3 Description of Data Samples

The Dataset contains five Excel files, named: Spring water survey.xlsx, Mineral water testing and analysis.xlsx, Karst collapse survey.xlsx, Karst cave survey.xlsx and Basic information of boreholes.xlsx.

The data file "Spring water survey.xlsx" (Table 2) contains the data items: field No., geographical location, map sheet No., spring type, aquifer lithology, main purposes, source of recharge, weather, atmospheric temperature, method for measuring flow, water flow, dynamic change features; the temperature, chroma, taste, odor, transparency, pH value, *Eh*, *DO* and *EC* of spring water; sampling, possible pollution source nearby, features of aquifer, remarks and date of survey.

The data file "Mineral water testing and analysis.xlsx" (Table 3) consists of test results from 7 water samples that reach the standard of mineral water. The test result of each sample is described in a single line and it contains No. of testing samples, analysis No. and the test indices of HBO_2, Cu, Pb, Zn, Ni, Co, Cd, Li, Mo, As, Hg, Sr, Ba, V, Se, Ag, I^-, K^+, Na^+, Ca^{2+}, Mg^{2+}, NH^{4+}, Fe^{3+}, Fe^{2+}, Cl^-, SO_4^{2-}, HCO^{3-}, CO_3^{2-}, NO_3^-, NO_2^-, F^-, PO_4^{3-}, pH, H_2SiO_3, Mn, Br^-, DO, free CO_2, soluble SiO_2, Cr^{6+} and Al^{3+}.

The data file "Karst collapse survey.xlsx" (Table 4) contains the information of the collapse points: field No., map sheet No., weather, geographical location, precursor of collapse, inducing factors; depth, plane morphology and profile morphology of collapse pit; whether underlying bedrock is visible, burial depth of water level, direction of long axis of collapse pit, whether there is any cave, elevation of river levels, radius of short axis of collapse pit, cave type, landform type, type of land utilization, collapse pits or lakes occurring nearby recently,

Table 2 Structure of "Spring water survey.xlsx" in the Dataset

No.	Data item name	Data type	Real example
1	Field No.	string	Q120
2	Geographic location	string	Group 8, Gonganquan Village, Fenghuangshan Town, Chibi City
3	Map sheet No.	string	Puqi Map Sheet (H49E014024)
4	Spring type	string	Gravity spring
5	Aquifer lithology	string	S2f2 muddy siltstone interbedded with sandstone
6	Main purpose	string	Not used
7	Source of recharge	string	Fissure water in clastic rocks
8	Weather	string	Clouds early/clearing late
9	Atmospheric temperature, ℃	float	33
10	Method of measuring flow	string	Flow meter
11	Spring flow (L/s)	float	0.16
12	Dynamic change features	string	According to visits, water flow varies with seasons and it increases after rain while decreases in the dry season; water flows all year round
13	Spring water temperature, ℃	float	18
14	Chroma	string	Colorless
15	Taste	string	Tasteless
16	Odor	string	Odorless
17	Transparency	string	Transparent
18	pH value	float	7.06
19	Sampling	string	No sample taken
20	*Eh*/mV	float	257
21	*DO* (mg/L)	float	6.12
22	*EC* (us/cm)	float	267.1
23	Possible pollution source nearby	string	No pollution source visible nearby
24	Aquifer feature	string	Geology: hybrid siltstone of the Silurian Fentou Formation. Landform: located in the transitional zone between low downland and accumulation terrace. Aquifer: fissured water-bearing formation of clastic rocks of the Silurian Fentou Formation in the western part of the survey point, with medium water richness. This spring was concurrently consumed by dozens of people in the previous production team according to investigations.
25	Remarks	string	According to visits, the water flow of this spring was up to 0.3 L/S before and then becomes very small after being discarded and unused for many years. It is located in the north wing of the anticline of the Wanghong Mount.
26	Date of survey	string	June 3, 2017

structure and thickness of soil layer, horizon and lithology of bedrock, whether the collapse has been treated, treatment plan, distribution of collapse bit cluster and date of survey.

Table 3 Structure of "Mineral water testing and analysis.xlsx" in the Dataset

No.	Data item name	Data type	Real example	No.	Data item name	Data type	Real example
1	No. of testing samples	string	Q02	23	Mg^{2+}/(mg/L)	float	4.14
2	Analysis No.	string	C172070002	24	NH^{4+}/(mg/L)	float	0
3	HBO_2/(mg/L)	float	0.012	25	Fe^{3+}/(mg/L)	float	0.046
4	Cu/(mg/L)	float	0.0010	26	Fe^{2+}/(mg/L)	float	0
5	Pb/(mg/L)	float	0.00030	27	Cl^-/(mg/L)	float	1.67
6	Zn/(mg/L)	float	0.0011	28	SO_4^{2-}/(mg/L)	float	19.3
7	Ni/(mg/L)	float	0.0078	29	HCO^{3-}/(mg/L)	float	266
8	Co/(mg/L)	float	0.0014	30	CO_3^{2-}/(mg/L)	float	0
9	Cd/(mg/L)	float	<0.0001	31	NO_3^-/(mg/L)	float	11.4
10	Li/(mg/L)	float	0.0030	32	NO_2^-/(mg/L)	float	0
11	Mo/(mg/L)	float	0.00020	33	F^-/(mg/L)	float	0.19
12	As/(mg/L)	float	0.0030	34	PO_4^{3-}/(mg/L)	float	0.022
13	Hg/(mg/L)	float	0.00010	35	pH	float	7.6
14	Sr/(mg/L)	float	0.36	36	H_2SiO_3/(mg/L)	float	11.8
15	Ba/(mg/L)	float	0.016	37	Mn/(mg/L)	float	0.0041
16	V/(mg/L)	float	0.0017	38	Br^-/(mg/L)	float	0.0090
17	Se/(mg/L)	float	0.00030	39	DO/(mg/L)	float	0.64
18	Ag/(mg/L)	float	0.00020	40	Free CO_2/(mg/L)	float	3.30
19	I^-/(mg/L)	float	0.0010	41	Soluble SiO_2/(mg/L)	float	9.10
20	K^+/(mg/L)	float	0.37	42	Cr^{6+}/(mg/L)	float	0
21	Na^+/(mg/L)	float	0.90	43	Al^{3+}/(mg/L)	float	0.068
22	Ca^{2+}/(mg/L)	float	91.4				

The data file "Karst cave survey.xlsx" (Table 5) contains the information of the cave survey point such as field No., map sheet No., geographical location, weather, temperature; the elevation, width, shape and direction of cave opening; samples and their quantities, landform type, cave utilization, landform location, strata and lithology, tectonic position, hydrogeology, engineering geology, cave description, remarks and date of survey.

The data file "Basic information of boreholes.xlsx" (Table 6) contains the data items such as field No., geographical location, map sheet No., borehole head elevation, drilling rip type, borehole type, start and end date of drilling, well deviation, open and final hole diameter, final hole depth, initial water level of aquifer, well depth, static water level, aquifer feature and date of survey.

4 Data Quality Control and Assessment

4.1 Data of Survey Points

The quality control of various survey points followed *Technical Requirement for Environmental Geological Survey* (1∶50 000) (DD 2019–07), *Specification for Hydrogeological Survey* (1∶50 000) (DZ/T 0282–2015) and *Standard Guide for Karst*

Table 4 Structure of "Karst collapse survey.xlsx" in the Dataset

No.	Data item name	Data type	Example
1	Field No.	string	TX446
2	Map sheet No.	string	Puqi Map Sheet (H49E014024)
3	Weather	string	Sunny
4	Geographical location	string	Group 8, Shaziling Village, Chimagang Town, Chibi City, Hubei Province
5	Precursor of collapse	string	Ground fissures
6	Inducing factors	string	Road construction, water pumping and stacking on the ground
7	Depth of collapse pit	float	3
8	Profile morphology of collapse pit	string	Jar-shaped
9	Plane morphology of collapse pit	string	Ellipse
10	Whether underlying bedrock is visible	string	No
11	Burial depth of water level/m	float	4.88
12	Direction of long axis of collapse pit	float	10
13	Caves	string	No
14	Elevation of river level/m	float	29.9
15	Radius of long axis of collapse pit/m	float	57.5
16	the radius of the short axis of collapse pit/m	float	35
17	Cave type	string	Soil cave
18	Landform type	string	Hills and plain
19	Type of land utilization	string	Dry land
20	Collapse pits or lakes occurring nearby recently	string	No
21	Soil layer structure	string	Single-layer structure: Qp brownish red reticulate silty clay, dense and hard
22	Soil layer thickness/m	float	5
23	Bedrock horizon	string	Lower-Triassic Jialing River Formation Tj
24	Bedrock lithology	string	Dolomitic limestone, limestone
25	Whether the collapse has been treated	string	Yes
26	Treatment plan	string	The #1 collapse pit was treated with a spanning fundamental emergency measure in 2010. It is flat and has been built into a part of Hebei Road now with no marked deformation visible, indicating a good treatment effect. The #2 collapse pit was filled with soil and compacted in 2012. It has been converted into an underground parking lot now and no collapse has ever happened so far.
27	Distribution of collapse bit cluster	string	The #2 collapse pit occurred in the vegetable plot which is 86 m SE from the # 1 collapse pit.
28	Date of survey	string	June 19, 2017

Table 5 Structure of "Karst cave survey.xlsx" in the Dataset

No.	Data item name	Data type	Example
1	Field No.	string	DX422
2	Map sheet No.	string	Puqi Map Sheet (H49E014024)
3	Geographical location	string	Group 9, Shaziling Community, Chimagang Office, Chibi City, Hubei Province
4	Weather	string	Sunny
5	Temperature (℃)	float	27
6	Cave opening elevation (m)	float	7.2
7	Cave opening width (m)	float	4.3
8	Cave opening shape	string	Arch
9	Cave opening direction (°)	string	290°, Northwest
10	Samples and their qualities	string	2 for simple chemical analysis (J21)
11	Landform type	float	Karst hills
12	Cave utilization	float	Not used
13	Landform location	string	Medium – bottom part of low hills
14	Stratam and lithology	string	Limestone of the Middle Member of Lower-Triassic Jialing River Formation (T_1j^2), attitude: 170°∠65°
15	Tectonic position	string	Located in the south wing of Puqi Syncline B8
16	Hydrogeology	string	The groundwater is fissure water in a carbonate-type karst with developed transportation channels. Inside the cave, water flows on the surface and water leaks and drops in some places of the ceiling. Water yield increases during cases of heavy rain and decreases in the dry season. The water flow is Q=193.34 L/S measured by the flow velocity method.
17	Engineering geology	string	The strike of the cave opening is 110° and the bedrock is exposed. The lithology of outcrops is characterized by thin-medium laminated, corroded and smooth gray limestone of the Middle Member of Lower-Triassic Jialing River Formation (T_2j), with the occurrence of 179°∠69° and small karrens and water-eroded grooves developed. Hard calcite veins are developed.
18	Cave description	string	The karst cave, with a strike of 110° and length of more than 50 m, extends nearly horizontally and one part with a length of about 30 m developed leftwards (100°). It is 3–6 m in width and 5–7 m in height inside, with lithostyle-shaped stalactites and travertines developed. Materials made of sand and stone washed out by water are visible in the water bottom (such as pebble and fine sand). It is inferred that the cave is located at an outlet of a subsurface river.
19	Remarks	string	Parameter values measured in this Survey: Q=192.57 L/S determined by flow velocity method; water temperature T=16.9°C, pH=7.2, Eh=253.0 mv, Ec=446.01 μs/cm and DO=9.01
20	Date of survey	string	June 14, 2017

Table 6 Structure of "Basic information of boreholes.xlsx"

No.	Data item name	Data type	Example
1	Field No.	string	SZK2
2	Geographic location	string	Group 16, Zhonghuo Village, Zhonghuopu Town, Chibi City, Hubei Province
3	Map sheet No.	string	Puqi Map Sheet (H49E014033)
4	Borehole head elevation/m	float	44
5	Drilling rig type	string	XY-2
6	Borehole type	string	Hydrological borehole
7	Start date of drilling	string	November 28, 2017
8	End date of drilling	string	December 17, 2017
9	Well deviation/°	float	0.5
10	Open hole diameter/mm	float	219
11	Final hole diameter/mm	float	130
12	Hole hole depth/m	float	152
13	Initial water level of aquifer/m		0.6
14	Well depth/m	float	152
15	Static water level/m	float	0.98
16	Aquifer features	string	Geology: it is revealed by the borehole that the soil layer at the depth of 9.00 m is Quaternary clay (Qh) and the rock layer at the depth of 9–152.00 m is gray limestone of P_1q. Landform: located in the bottom of downland, with topography rising and falling slightly. Aquifer: main water-bearing segment is located at the depth of 9–152.00 m, with the borehole at the depth of 21.6–26.1 m and karst caves at the depth of 29.1–30.40 m; the aquifer bears karst water, with medium water richness.
17	Date of survey	string	December 17, 2017

Collapse Investigation (1∶50 000) (the version for approval). The Beijing Geodetic Coordinate System 1954 was adopted. The coordinates of the survey points were determined with a portable GPS device and are consistent with the information of surface features and the data in topographical maps. The collation of the data of survey points includes data filling and checking in the field, indoor check of the data and data verification during the input of data into the database. A three-level quality inspection system was adopted for checks and the procedures of self-check, mutual check and spot check were performed.

4.2 Data of Water Sample Testing

Water samples acquired were tested by the Changsha Mineral Resources Supervision and Inspection Center, Ministry of Land and Resources (Hunan Province Geological Testing Institute), which is a national qualified testing organization.

Standard solution sample insertion and standard recovery test were adopted in order to guarantee the accuracy of the water sample tests. A test value within two times of the

uncertainty range of a given reference value and the recovery rate ranging 90–110% were respectively taken as the acceptance criterions of the two methods (Gong L et al., 2019).

Repeated tests were adopted to ensure the precision of the water sample tests. 20% of the water samples in each batch were randomly selected for verification. They were coded and tested at the same time. The permitted limit of relative deviation (Y=11.0 C·X–0.28) of water quality tests stipulated in *The Specification of Testing Quality Management for Geological Laboratories – Part6*: *Water Analysis* (DZ/T 0130.6–2006) was adopted as the acceptance criterion (Ma HY et al., 2018).

4.3 Borehole Data

Quality control of the hydrogeological borehole data is strictly compliant with *Specification for Hydrogeological Survey* (1∶50 000) (DZ/T 0282–2015) and *Specification for Hydrological Well Drilling* (DZ/T 0148–2014).

The technical requirements of hydrogeological drilling construction were prepared and the drilling construction was respectively recorded by roundtrip and stratum. The quality of each borehole was audited and the qualified rate of drilling construction quality is 100%. To ensure the quality of drilling data during the whole process of drilling, a series of drilling materials were filled or prepared, such as the data tables of borehole quality check and borehole quality acceptance, borehole design document and the data table of basic borehole information. As a result, complete materials and records of drilling were achieved. Only the data table of basic borehole information was included in this Dataset. The number of boreholes, footage and construction quality were all compliant with the applicable specifications.

5 Value of the Data

This Dataset summarized the environmental geological data obtained from the geological survey, drilling, testing and analysis in the urban area and its surrounding towns of Chibi City. It will be widely applied in the following three aspects.

(1) The Dataset contains the data collected from the karst collapse points and hydrogeological boreholes drilled. Based on these data, the distribution of karst collapse, the major environmental geological problem in Chibi City; the structure and thickness of soil layer in the covered karst area and also the development level of karst in the covered karst area were determined. All these lay a foundation for the zoning and assessment of karst collapse and will provide a further geological basis for the planning and construction of towns and safe utilization of land in Chibi City.

(2) The Dataset contains the data collected from various spring points and karst caves, which reflect the potentially rich geological resources in Chibi City and provide optional goals for the development of geological tourism resources in the city. In combination with existing geothermal resources (such as the Wuhongshan thermal spring) and the geological relic landscapes (including ancient battlefields of the Three Kingdoms Period and Yanglou cave), a multi-stop high-quality tourism route or tourism town with unique features can be jointly built.

(3) Most mineral water is rich in Se in Chibi City according to the results of mineral water

testing, with Se content reaching the standard of mineral water. Especially in the Wenjiashan area of Chibi City, the springs are distributed like moniliform with a large water yield and the water in springs and hydrological boreholes are all rich in Se according to the test results. Furthermore, the soil is also rich in Se with the Se content of up to 2.04 mg/kg (data source: results of trace element testing of soil samples). Therefore, Chibi City boasts rich mineral water resources and great potential for development and utilization accordingly and it can be developed into a perfect base to cultivate high-quality agricultural products.

6 Conclusion

The Dataset consists of five data files in Excel, named Spring water survey.xlsx, Mineral water testing and analysis.xlsx, Karst collapse survey.xlsx, Karst cave survey.xlsx and Basic information of boreholes.xlsx. It will provide basic geological data for the planning and construction of towns, safe utilization of land and construction of critical projects in Chibi City. Furthermore, it will provide significant references for the development and utilization of regional high-quality geological resources.

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