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1：50 000 山东毕郭幅地球化学数据集

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摘要: 该数据集依托中国地质调查局“山东莱州–招远地区金矿整装勘查区矿产调查与找矿预测”项目，在充分收集地质、物探、化探、遥感及矿产等资料基础上，开展毕郭幅矿产地质调查。项目共采集 1 875 件水系沉积物样品，采样粒级为−10～+80 目，平均采样密度 4.5 个 /km^2。采用电感耦合等离子质谱法（ICP-MS）、原子荧光光谱法（AFS）、粉末发射光谱法（ES）和石墨炉原子吸收光谱法（GF-AAS）分析了 16 种元素，最终形成 1：50 000 山东毕郭幅地球化学数据集，数据集包含有 1 875 件样品×16 种元素的原始分析数据表格一个，图集一套（含有 1 张矿产地质图、一张采样点位图和 16 张元素地球化学图）。区内共新发现单元素地球化学异常 149 处，综合异常 10 处，结合地质、矿产、物探、化探、遥感等信息并圈出金矿找矿靶区 5 处。

关键词: 山东；毕郭；地球化学；水系沉积物；数据集

数据服务系统网址: http://dcc.cgs.gov.cn

1　引言

2016 年 6 月 27 日，中国地质调查局发展研究中心与山东省地质调查院确定合作开展“山东莱州–招远地区金矿整装勘查区矿产调查与找矿预测”（“整装勘查区找矿预测与技术应用示范”二级项目的子项目，项目编号 121201004000150017-60）。项目主要任务是在系统收集和综合分析已有地质、物探、化探、遥感、矿产等资料基础上，采用数字填图技术，开展毕郭幅（J51E017003）1：50 000 矿产地质专项填图、1：50 000 水系沉积物测量、综合检查，开展找矿预测，圈定找矿靶区，评价资源潜力，提出下一步找矿工作部署建议。

山东毕郭幅位于毕郭–寺口金成矿区（倪振平等，2014），区内属丘陵地貌，地势总体北高南低，形成西、北、东北部山岭，中、南部岭盆的地形格局（图 1）。该区岩性以侵入岩为主，火山岩和沉积岩零星分布，地质构造复杂，成矿地质条件优越，属栖

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霞金矿田重要组成部分。区内共有矿床、矿点、矿化点 18 处，其中金属矿 12 处，非金属矿 6 处。金属矿均为金矿，已发现笏山中型金矿，台前小型金矿及孙疃、大河崖、杨家岭、三宿夼等矿点。非金属矿主要为磷矿、橄榄霞石岩矿及高岭土、阳起石矿。

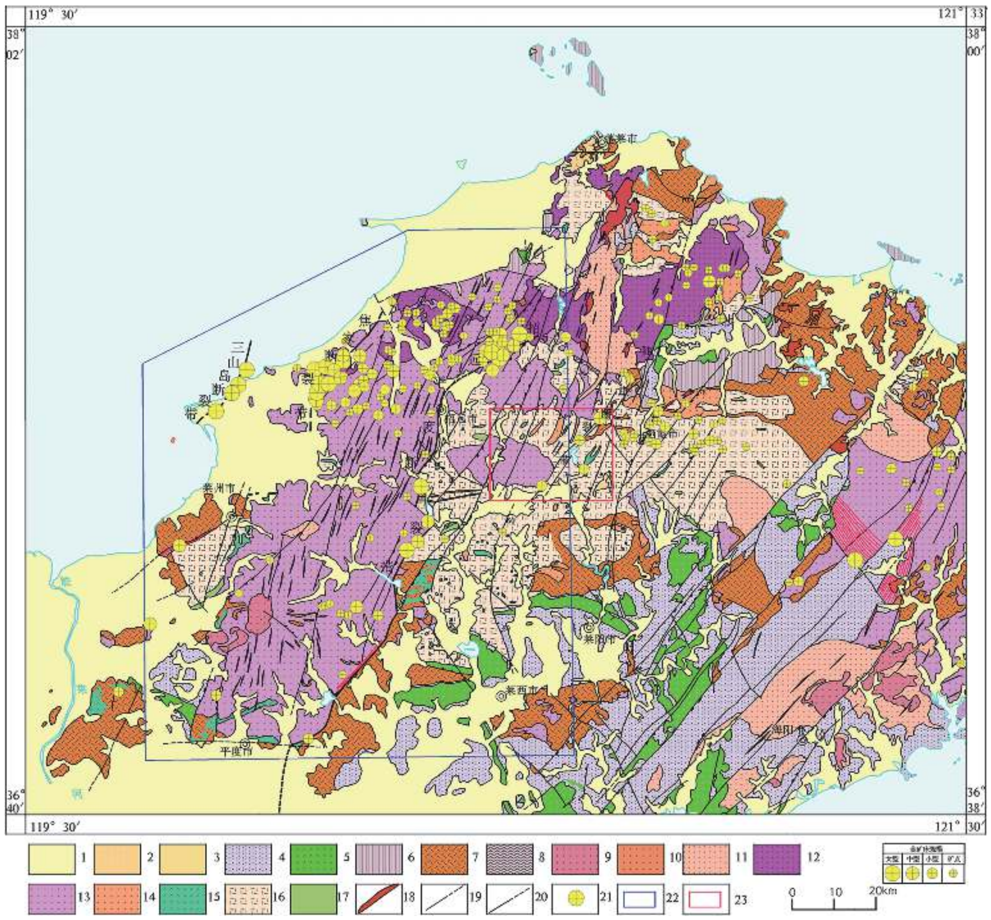

图 1　山东莱州–招远整装勘查区区域地质简图

1—第四系；2—新近纪火山岩；3—古近纪沉积岩；4—白垩纪沉积地层；5—白垩纪火山岩；6—中、新元古代变质地层；7—古元古代变质地层；8—太古宙变质地层；9—白垩纪崂山花岗岩；10—白垩纪雨山花岗岩；11—白垩纪伟德山花岗岩；12—白垩纪郭家岭花岗岩；13—侏罗纪玲珑花岗岩；14—古元古代大柳行片麻状花岗岩；15—元古宙基性–超基性岩；16—太古宙 TTG 片麻岩；17—太古宙变质基性–超基性岩；18—中生代脉岩；19—实测（推测）断裂；20—实测（推测）主控矿断裂带；21—金矿床；22—整装勘查区范围；23—调查区范围

本项目从 2016 年 7 月开始至 2019 年 1 月结束，累计完成毕郭幅 413 km^2 范围的 1∶50 000 水系沉积物地球化学测量。最终成果为地球化学数据集，包括一个 Excel 表格，含有 1 875 件样品×16 种元素的原始分析数据（表 1）；一个图集，含有 1 张矿产地质图、1 张采样点位图和 16 张元素地球化学图。

表 1　数据库（集）元数据简表

条 目	描 述
数据库（集）名称	1∶50 000山东毕郭幅地球化学数据集
数据库（集）作者	智云宝，山东省地质调查院 王增辉，山东省地质调查院 魏正宇，中国冶金地质总局山东正元地质勘查院 赵西强，山东省地质调查院

续表 1

条 目	描 述
数据时间范围	2016.07—2019.01
地理区域	位于胶东半岛西北部，莱州–招远金矿整装勘查区东部，属山东1：50 000毕郭幅，面积约413km^2。地理坐标：东经120°30′00″ ~ 120°45′00″，北纬37°10′00″ ~ 37°20′00″。
数据格式	*.xlsx, *.jpg; *.wt, *.wl, *.wp; *.la, *.lm, *.pa, *.pm, *.ta, *tm
数据量	243 Mb
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“整装勘查区找矿预测与技术应用示范”（121201004000150017）子项目“山东莱州–招远地区金矿整装勘查区矿产调查与找矿预测”（121201004000150017-60）资助
语种	中文
数据库（集）组成	包括一个Excel表格，含有1 875件样品×16种元素的原始分析数据；一个图集，含有1张矿产地质图、1张采样点位图和16张元素地球化学图。

2 数据采集及处理方法

2.1 野外定点

根据调查区的特点以及区内景观地球化学条件，结合前人地质及地球化学资料为依据，水系沉积物布点采用了 1：50 000 标准图幅地形图为底图布置。采样点布置在一级水系口、二级水系中，对一级水系长度大于 500 m 加布 1 个或多个采样点。采样点控制汇水域面积不小于 0.125 km^2，不大于 0.25 km^2，保证其均匀性，同时避免人为影响。

2.2 采样密度

设计采样密度一般地区为 4 点/km^2，在控矿断裂带及矿化较好地段适当加密。实际采样 1 875 个，平均采样密度为 4.5 个/km^2。

2.3 采样方法

在水系发育区域，采样点选择在水系、沟谷底部，或者是各种粒级的冲积物易于汇集处，譬如，水线附近、河道转弯内侧、砂嘴前缘等部位。为提高每个样品的代表性，在采样点附近 30 m 范围内进行多点（3 ~ 5 处）采样，合并成为一个组合样。在羽状水系分布地区，采用一个单元内多条并列水系采样组合成一个样品；在间隙性流水、干沟或干河道中，选取河床底部采集中细粒物质，排除风成物干扰。

在连续的花岗岩风化残积区内明显的凹型地貌景观区采样时，按照凹型地貌中线确定流水线，以此为中心，向两侧横截宽缓的负地形面等量采集 3 ~ 5 件土壤样品，采样部位为残坡积发育地段；在地表径流不明显或无典型径流的细小水系或者山前水系采样时，样品采集在较大的水系，沿径流方向有效采集。

野外采集原始样品要求重量大于 500 g，样品采集粒级为 – 10 目 ~ + 80 目，最终筛分出来的样品重量大于 300 g。

2.4 样品加工

样品加工基本流程为（陈玉明和陈秀法，2018）：自然干燥→揉碎→过筛→混匀→称重→填写标签→装瓶→装箱→填写送样单→入库。

① 样品干燥方式为自然日晒风干。干燥过程经常揉搓、木棒轻敲，以免结块，雨

季特别注意防止下雨、风沙或人为因素等造成样品的散失或沾污。

②采用 10 目套 80 目不锈钢筛，对充分干燥后的样品过筛，弃去筛上物，保留筛下物，截取的样品重量大于 300 g。

③按四分法缩分配置分析样，分析样重量 150 g，用牛皮纸袋和塑料瓶封装；另 150 g 作为副样，用瓶封装。

④分析样运送至中国冶金地质总局山东局测试中心进行 16 种元素分析测试，副样由山东省地质调查院长期保存。

3 数据样本描述

3.1 数据特征

山东毕郭幅 1∶50 000 地球化学集，包含一个 Excel 表格《毕郭幅 1∶50 000 地球化学分析数据》，含有 1 875 件样品的 Au、Ag、Cu、Pb、Zn、As、Sb、Bi、Mo、Hg、Sn、W、Cd、Cr、Co、Ni 共 16 种元素的原始分析数据（表 2）；一个图集《毕郭幅 1∶50 000 地球化学图集》，含有 1 张矿产地质图、1 张采样点位图和 16 种元素地球化学图（图 2）。

表 2 毕郭幅元素地球化学分析数据表

序号	字符名称	数据类型	实例	序号	字符名称	数据类型	实例
1	分析批号	字符型	HF2016-240	11	Bi	浮点型	0.22
2	实验室编号	字符型	F201616461	12	Mo	浮点型	0.70
3	样品号	字符型	1d1	13	Hg	浮点型	17.6
4	Au	浮点型	2.79	14	Sn	浮点型	1.06
5	Ag	浮点型	0.11	15	W	浮点型	0.76
6	Cu	浮点型	23.6	16	Cd	浮点型	0.10
7	Pb	浮点型	20.9	17	Cr	浮点型	62.4
8	Zn	浮点型	55.9	18	Co	浮点型	17.4
9	As	浮点型	4.30	19	Ni	浮点型	23.2
10	Sb	浮点型	0.48				

注：元素含量单位：Au、Hg为10^{-9}，其他元素为10^{-6}。

3.2 地质特征和分区

本区出露的主要地质体为太古代和中生代侵入岩。太古代侵入岩从早期的变辉石岩到晚期英云闪长质片麻岩，反映从早期的拉张环境下幔源超铁镁质–铁镁质岩浆上侵，至后期的聚合环境，幔源岩浆部分分异的同时，有壳源物质的混入，形成栖霞片麻岩序列（王世进等，2009）。

中生代燕山期晚阶段发生了广泛的构造活动，从拉张环境下幔源基性岩浆上侵，到板块碰撞同造山花岗岩形成，再到造山后伸展体制下壳幔源物质交代，造成上地壳重熔而形成玲珑花岗岩。

新近纪以大规模的火山喷发沉积为特征。为了解各元素在不同地质体中的分布规律，根据岩性差异，将全区划分为 3 个地质子区（图 3）。分别为第四纪冲积层子区（Q）、侏罗纪二长花岗岩子区（J）和太古代片麻岩系子区（Ar）。

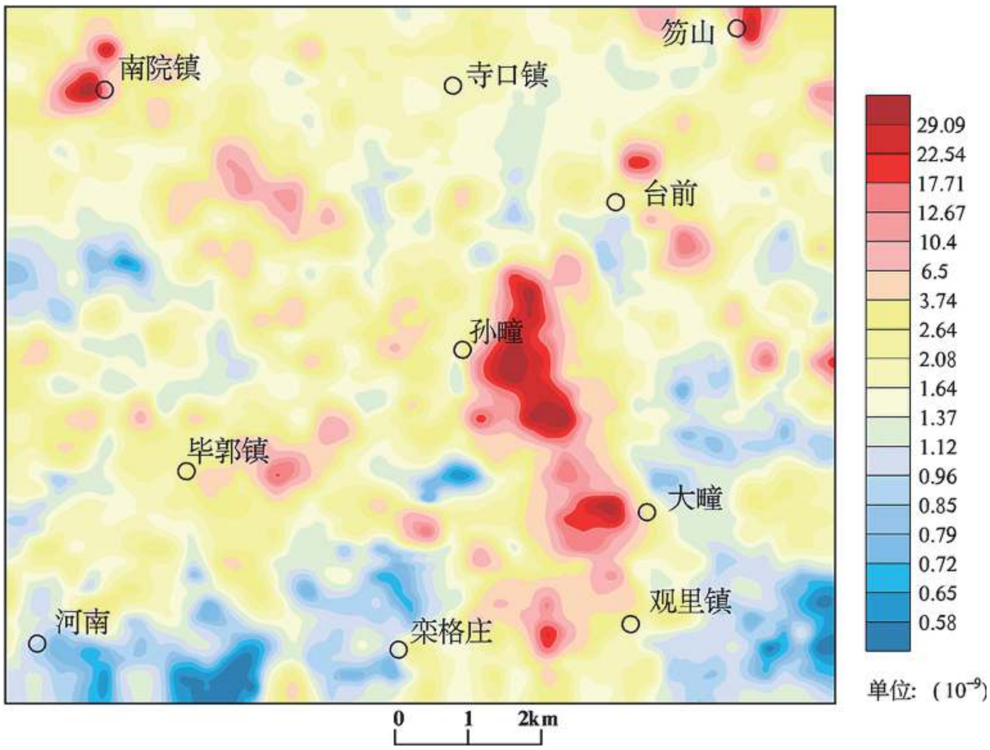

图 2　毕郭幅金元素地球化学图

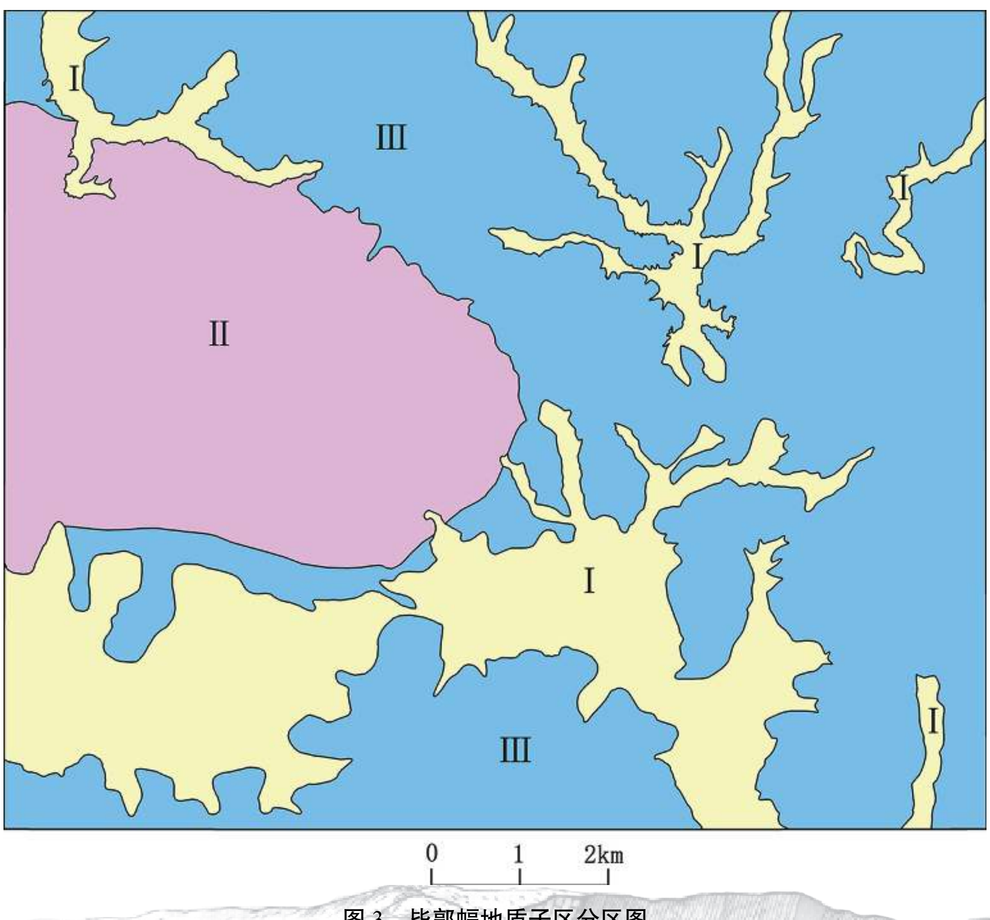

图 3　毕郭幅地质子区分区图

Ⅰ 第四纪冲积层；Ⅱ 侏罗纪二长花岗岩；Ⅲ 太古代片麻岩系

3.3 元素地球化学特征

统计了调查区和各地质子区的各元素参数特征值，以此反映调查区元素在不同地质单元中的分布特征及与地质成矿有关的地球化学过程（表 3）。

表 3 毕郭幅各地质子区元素参数特征对比表

元素均值（X）地质子区	Au	Ag	Cu	Pb	Zn	As	Sb	Bi
Q	3.855	0.091	26.582	19.828	49.895	5.05	0.456	0.179
J	2.75	0.057	12.395	29.351	38.703	2.787	0.409	0.158
Ar	4.335	0.093	36.514	19.31	61.874	4.3	0.441	0.222
全区	3.83	0.085	29.076	22.054	54.766	4.254	0.444	0.2
元素均值（X）地质子区	Mo	Hg	Sn	W	Cd	Cr	Co	Ni
Q	0.545	16.718	1.353	0.867	0.104	47.798	11.629	21.768
J	0.363	9.101	1.282	0.519	0.057	24.963	5.24	11.516
Ar	0.584	17.635	1.43	0.909	0.118	64.641	16.693	31.406
全区	0.536	15.46	1.406	0.818	0.102	52.288	13.226	25.052

注：表中“X”为调查区各单元及全区算数均值；岩性：Ar–太古代片麻岩系子区，J–侏罗世二长花岗岩子区，Q–第四纪沉积层子区。其中，Au、Hg为$\times10^{-9}$，其余元素为$\times10^{-6}$。

从表 3 可以看出，在太古代片麻岩系子区（Ar），水系沉积物中多种元素含量明显高于全区背景含量的元素组合，特别是亲铁元素 Ni、Co、Cu、Cr、Zn 等元素含量明显偏高，为区内成矿提供了重要的物质来源；Ag、As、Sn、Bi、Mo 五元素含量与全区平均含量相当，该地层中 Pb 元素含量虽低于全区平均含量，但离差、变化系数较大，且明显高于全省其他地区，在构造发育地段也存在形成元素局部富集的可能。在侏罗世二长花岗岩子区（J）内，水系沉积物中所测元素含量亦普遍低于全区平均含量，这反映了与新近系不同的富集特征。但 Pb、Cd 元素的含量略高于全区平均值，离散度大，表明该区可能为 Pb、Cd 成矿的重要地区。第四纪沉积层子区（Q）中 Au、Ag、Mo、Cd、As、W、Hg、Sb 元素较为富集，且 As、Cd、Sb 等浓集克拉克值>1，说明水系沉积物中这些元素沿汇水域风化后物质搬运较好，反映了所在区域内原岩的元素地球化学含量分布特点。

4 数据质量控制和评估

16 种元素分析测试由中国冶金地质总局山东局测试中心承担。分析元素为 Au、Ag、Cu、Pb、Zn、As、Sb、Bi、Mo、Hg、Sn、W、Cd、Cr、Co、Ni。分析方法以电感耦合等离子质谱法（ICP-MS）和原子荧光光谱法（AFS）为主，辅以粉末发射光谱法（ES）和石墨炉原子吸收光谱法（GF-AAS）。每一种元素的分析方法、分析方法的检出限、地球化学普查规范（1∶50 000）（DD2009-xx）要求的检出限、报出率等见表 4。

表 4 分析方法的检出限及分析元素报出率

元素编号	被检测的元素		分析方法的检出限	规范要求的检出限	报出率（%）	分析方法
1	Au	金	0.0003	0.0003	98.7	GF-AAS
2	Ag	银	0.02	0.03	99.62	ES
3	Cu	铜	0.5	1.5	99.9	ICP-MS
4	Pb	铅	0.5	5	99.9	ICP-MS

续表 4

元素编号	被检测的元素		分析方法的检出限	规范要求的检出限	报出率（%）	分析方法
5	Zn	锌	1	15	99.95	ICP-MS
6	As	砷	0.2	1	99.52	AFS
7	Sb	锑	0.1	0.2	99.9	AFS
8	Bi	铋	0.02	0.1	99.86	ICP-MS
9	Mo	钼	0.05	0.5	100	ICP-MS
10	Hg	汞	0.005	0.005	93.28	AFS
11	Sn	锡	0.2	1	100	ICP-MS
12	W	钨	0.05	0.5	99.86	ICP-MS
13	Cd	镉	0.03	0.1	98.18	ICP-MS
14	Cr	铬	2	15	99.9	ICP-MS
15	Co	钴	0.1	1	99.95	ICP-MS
16	Ni	镍	0.5	3	100	ICP-MS

注：电感耦合等离子质谱法（ICP-MS），粉末发射光谱法（ES），原子荧光光谱法（AFS），石墨炉原子吸收光谱法（GF-AAS）。

质量管理采用外部质量监控和内部质量监控相结合，以外部质量监控为主的原则。外部质量监控是按 4% 的比例插入标准控制样，共插入 80 件。内部质量监控是将每 50 件分析样品编为一组，插入 4 个水系沉积物一级标准物质，分别为 As、Sb、Hg（GSS-8、GSD-9、GSD-10、GSD-14），Co、Cr、Cu、Zn、Mo、Sn、Pb、W、Bi、Ni、Cd（GSS-8、GSD-9、GSD-10、GSD-14），Ag（GSS-8、GSD-9、GSD-10、GSD-14）。按每一批次为统计单元，分别计算每个元素标准物质或监控样的测量值与标准值的对数差 $\Delta \lg C$，以控制分析的准确度；计算每种元素 4 个标准物质平均对数差的标准偏差 λ，用以衡量同批样品的精密度。

Au 元素分析质量监控：按 50 个样品为统计单元，插入 5 个国家一级标准物质（GAu2b、GAu7a、GAu9b、GAu11a、GAu12），对应含量分别为 0.86、3.1、1.5、10.5、20.8 作为金分析监控样。

内检样品及异常点质量监控：内检样品按样品总数的 8% 进行检查分析。对部分元素含量较高或较低的样品进行异常抽查。各元素的内检分析和异常值抽查的质量控制均按相对偏差$|RD\%| \leqslant 25\%$ 统计合格率，一次原始合格率≥90%。

此次所有监控样的 16 种元素合格率为 100%。测试样品总数随机抽取约 8% 作为内检样品，内检总数为 166 件，内检总项数为 2 656 项，内检合格率为 99.13%。

为避免因分析偶然误差所造成的地球化学假象，每批样品分析完成后，均对部分分析结果的突变高点和低点进行重复性检验。异常点抽查的总项数为 1 440 项，总合格项数为 1 440 项，合格率为 100%。内检样品和异常值抽查的总合格率为 99.44%。

5 数据处理

本次数据处理软件采用 IBM 公司的 SPSS 19.0，制图软件采用新疆金维多元地学应用软件 GeoIPAS V3.2。

（1）数据处理

对调查区内的 16 种元素的原始数据集，以（$\bar{x} \pm 3S$）进行循环迭代剔除离群数据，

直到无离群数值可剔除为止，形成背景数据集，以剔除离群全域均值（$\bar{x}$）和标准离差（S）为依据计算异常下限（T），计算方法为$T = \bar{x} + 2S$，最终确定异常下限值。

（2）数据网格化

网格距为 250 m×250 m，搜索半径 1 250×1 250，采用幂指数加权模型的参数进行数据网格处理。

（3）元素地球化学图

等值线色区选取用中国地质调查局规定的 7 级色阶法，用其对应的含量间隔勾绘等量线成图，各色级色阶内不同等量线间隔采用过渡色阶表示，使用同一色阶内相关区带达到渐变效果。对应色区从深蓝（强低值区）–蓝（低值区）–浅蓝（低背景区）–浅黄（背景区）–浅红（高背景区）–红（高值区）–深红（强高值区）等逐渐进行过渡。

（4）质量保证

编图及资料整理中全部原始数据的转录、成图及计算均进行 100% 复核。

6 异常圈定及特征

（1）异常圈定

根据研究对象的元素组合特征，分为 3 类组合异常。一类为 Au、As、Sb、Hg 异常组合；二类 Cu、Zn、Cr、Co、Ni 异常组合；三类 W、Sn、Bi、Pb、Ag 异常组合。根据异常组合、面积、强度、地质环境因素等进行筛选，将在地质环境、成因及空间等有明显联系的一组异常迭加部分进行异常圈定。对异常元素组合差及成矿地质条件差的异常，进行选择性的经验剔除；对个别分布面积较大的单元素异常，要综合考虑地质条件、元素组合边界，并在相互连接薄弱处或典型分水岭部位，对其进行人为分割，构成综合异常。全区共圈定综合异常 10 个。

（2）异常总体特征

区内主要异常带总体与区域构造相一致，东北部主要沿 NE 向带状展布，从 NE 向 SW 依次为笏山–台前异常带、孙疃异常带，以及三宿夼异常带等；南部主要沿近 EW 向带状展布的毕郭异常带。

从异常分布的地质背景来看，NE 向异常带沿台前–陡崖断裂带分布（廖明伟等，2014；许方，2008），带内主要发育新太古代栖霞序列新庄单元和谭格庄序列牟家单元，另有少量的马连庄序列大吴家、栾家寨单元呈大小不等的包体赋存于片麻岩中（王世进等，2009）。物探表现为高磁低重力特征，遥感上表现蚀变异常信息密集，展布与构造一致，信息提取率高。

笏山–台前异常带是以 Au 为主的 Bi、Hg、Ag、W、Mo、Cd、As、Sn、Sb、Cu 组合异常，异常呈不规则矩形状北东向分布，异常面积约 12.71 km^2，异常浓度较高。Au 异常有多点内带异常，有两个异常浓集中心，异常峰值为 345×10^{-9}。区内已发现笏山和台前金矿床。

孙疃异常带是以 Au 为主的 Ag、Cd、Cu、Mo、Pb、Bi、As、Sb、Hg 组合异常，异常呈不规则椭圆形状北西向分布，异常浓度较高，Au、Mo、Ag、Bi、Cd、W、Hg 均发育有三个浓度分带。Au 异常面积为 12.98 km^2，峰值为 190×10^{-9}。区内发育已发现孙疃和大河崖金矿床。

三宿夼异常带以 Au 为主的 Ag、Hg、Zn、Pb、Ni、Cu、Cr、Co、Cd 组合异常，

异常呈北东向不规则状展布，异常面积 4.802 km^2，异常浓度较高。其中 Au 发育有 3 个浓度分带，异常面积为 2.41 km^2，峰值为 29.4×10^{-9}。各元素异常浓度中心叠合较好，异常元素组合较全。区内发育 1 处金矿点。

近 EW 向异常带沿毕郭断裂带展布，该断裂带赋存于毕郭花岗岩与太古代新庄单元片麻岩接触带上及附近[3]，Au、Ag、Pb、Zn 等元素异常套合好，强度较高，各元素异常浓度中心叠合较好。物探表现为低重力、串珠状高磁特征，遥感上表现为解译数据中异常密集、展布与构造一致、蚀变异常提取率高。带内现有金矿点 1 处，矿化点 2 处。

7　结论

山东省地质调查院与中国冶金总局山东正元地质勘查院开展实施的毕郭幅 1∶50 000 水系沉积物测量工作，历时近 3 年，获得了珍贵的第一手地球化学测量数据资料，以及以此为基础编制而成的地球化学图集。

通过开展 1∶50 000 水系沉积物测量，取得了客观反映调查区内各元素分布规律及地质矿产信息资料，圈定了一批具有找矿价值的化探异常，为该区开展找矿提供可靠的地球化学信息。

通过矿产地质调查工作，理顺了区内侵入岩形成序列、成因，以及侵位机制；总结了区内成矿地质体、成矿构造，以及成矿作用特征。结合地质、地球物理、地球化学、遥感及矿产特征，进一步圈定金矿找矿靶区 5 处。

数据集的建立为该区域提供了一套基础性的数据资源，可最大限度的满足其他科研人员对该区水系沉积物测量信息的查询需求，为实现信息资源共享创造了条件。

致谢：衷心感谢中国地质调查局发展研究中心、中国冶金总局山东正元地质勘查院对项目的大力支持。

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China Geological Survey Project "Mineral Survey and Prospecting Prediction of Integrated Exploration Areas of the Gold Deposits in the Shandong Zhaoyuan-Laizhou Area" (1212010040 00150017-60), a sub-subject of the project named "Demonstration Project of Prospecting Prediction and Technical Application in Integrated Exploration Areas" initiated by the Development and Research Center of the China Geological Survey (121201 004000150017)

Geochemical Dataset of the 1∶50 000 Shandong Biguo Map Sheet Area

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Abstract: The geochemical dataset of the 1∶50 000 Shandong Biguo map sheet area (also referred to as "the Area") was achieved by carrying out a mineralogical survey of the Area based on the project entitled *Mineral Survey and Prospecting Prediction of Integrated Exploration Areas of the Gold Deposits in the Shandong Zhaoyuan-Laizhou Area* initiated by the China Geological Survey, as well as through extensive data collection of geological information, geophysical prospecting, geochemical prospecting, remote sensing, and mineralogy. A total of 1 875 stream sediment samples were collected, with sampling size fractions of −10 ~ +80 mesh and an average sampling density of 4.5 sampling points per km^2. Furthermore, 16 elements were analyzed by the methods of inductively coupled plasma mass spectrometry (ICP-MS), atomic fluorescence spectrometry (AFS), powder emission spectrometry (ES), and graphite furnace atomic absorption spectrometry (GF-ASS). The final geochemical dataset contains an Excel file and an atlas. The Excel file consists of the original analysis data of 16 elements from the 1 875 samples. The atlas comprises one mineralogical map, one sampling point bitmap and 16 element-specific geochemical maps. A total of 149 geochemical anomalies of single elements and 10 integrated anomalies were discovered in the Biguo map sheet area, as a result of this work. In addition, five prospecting target areas of gold deposits were determined through examining the information obtained from the geological investigation, mineralogical survey, geophysical prospecting, geochemical prospecting and remote sensing.

Key words: Shandong; Biguo; Geochemistry; Stream sediment; Dataset
Data service system URL: http://dcc.cgs.gov.cn

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1 Introduction

On June 27, 2016, the Development and Research Center of China Geological Survey and the Shandong Institute of Geological Survey formed a collaborative partnership to carry out the project entitled *Mineral Survey and Prospecting Prediction of Integrated Exploration Areas of the Gold Deposits in the Shandong Zhaoyuan-Laizhou Area*. This project is a sub-project of a second-level project of a project entitled *Demonstration Project of Prospecting Prediction and Technical Application in Integrated Exploration Areas* (121201004000150017-60). The project was based on the systematic collection and comprehensive analysis of existing data from geology, geophysical prospecting, geochemical prospecting, remote sensing and mineralogy. The main tasks were as follows: Firstly, to carry out 1∶50 000 special mineralogical mapping, as well as the measurement and comprehensive examination of 1∶50 000 stream sediment maps of the Area (J51E017003) by adopting digital mapping techniques; Secondly, to carry out prospecting predictions, determine the prospecting target areas, assess the resource potential, and propose suggestions on the deployment of prospecting work in the next phase.

Lying in the Biguo-Sikou gold metallogenic province, the Shandong Biguo map sheet area (also referred to as "the Area") (Ni ZP et al., 2014) consists of hilly terrain, high in the north and low in the south (Fig. 1). In this fashion, the landscape pattern is formed, with mountains in the west, north, and northeast, as well as mountain ridges and basins in the middle and the south. In terms of the lithology of this area, intrusive rocks are predominant with volcanic and sedimentary rocks being only sporadically distributed. Benefiting from the complex geological structure and favorable metallogenic geological conditions, the Area is an important part of the Qixia gold ore field. There are ore deposits, ore occurrences, and mineralized points within the area totalling 18 in number, consisting of 12 metallic ores and 6 non-metallic ores. All of the metallic ores are gold and Hushan is a medium-scale gold deposit, Taiqian a small-scale gold deposit and in addition there are also ore occurrences such as Suntuan, Daheya, Yangjialing and Sankukuang that have been found. The non-metallic ores mainly consist of phosphorus deposits, olivine nephelinite deposits, kaolin deposits, and actinolite deposits.

The project lasted from July 2016 to January 2019, and the geochemical survey of the 1∶50 000 stream sediment maps covering a range of 413 km^2 in the Area were completed. The final result of this project is a geochemical dataset containing an Excel file and an atlas. The Excel file consists of the original analysis data (see Table 1) of 16 elements from the 1 875 samples. The atlas comprises one mineralogical map, one sampling point bitmap and 16 element-specific geochemical maps.

2 Data Acquisition and Processing Methods

2.1 Determination of Field Sampling Points

The field sampling points for the stream sediments were selected through adopting a 1∶50 000 standard map sheet topographic base map, then taking into account the characteristics of the Area, as well as the landscape geochemical conditions in the Area, as well

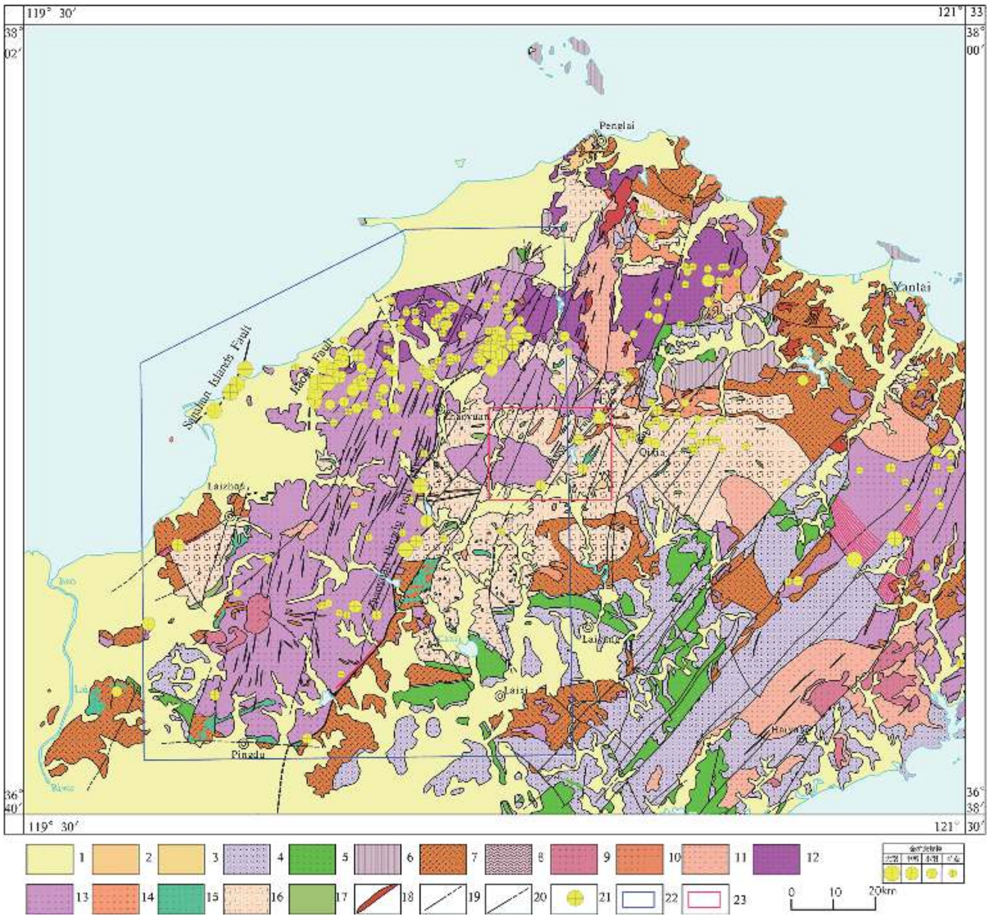

Fig. 1 Regional generalized geological map of the Shandong Zhaoyuan-Laizhou integrated exploration areaSchematic geological diagram

1–Quaternary System; 2–Neogene volcanic rock; 3–Paleogene sedimentary rock; 4–Cretaceous sedimentary strata; 5–Cretaceous volcanic rock; 6–Meso-Neoproterozoic metamorphic strata; 7– Paleoproterozoic and Mesoproterozoic metamorphic strata; 8–Archaean metamorphic strata; 9–Cretaceous Laoshan granite; 10– Cretaceous Yushan granite; 11– Cretaceous Weideshan granite; 12–Cretaceous Guojialing granite; 13–Jurassic Linglong granite; 14–Paleoproterozoic Daliuhang gneissic granite; 15– Proterozoic basic-ultrabasic rock; 16– Archaean TTG gneiss; 17– Archaean metamorphic basic-ultrabasic rock; 18–Mesozoic dike rock; 19–Measured (inferred) fracture; 20–Measured (presumed) main ore-controlling fracture zone; 21–Gold deposit; 22–Range of integrated exploration area; 23–Range of the Area.

Table 1 Metadata Table of Database (Dataset)

Items	Description
Database (dataset) name	Geochemical Dataset of the 1：50 000 Shandong Biguo Map Sheet Area
Database (dataset) authors	Zhi Yunbao, Shandong Institute of Geological Survey Wang Zenghui, Shandong Institute of Geological Survey Wei Zhengyu, Geological Exploration Institute of Shandong Zhengyuan, China Metallurgical Geology Bureau Zhao Xiqiang, Shandong Institute of Geological Survey
Data acquisition time	2016.07—2019.01
Geographic area	In the northwest of the Jiaodong Peninsula, in the east of the Integrated Exploration Areas of the Gold Deposits in the Shandong Zhaoyuan-Laizhou Area, and in the 1：50 000 Biguo map sheet area.Geographical coordinates: east longitude 120°30′00″ ~ 120°45′00″ and north latitude 37°10′00″ ~ 37°20′00″

Continued table 1

Items	Description
Data format	*.xlsx, *.jpg, *.wt, *.wl, *.wp *.la, *.lm, *.pa, *.pm, *.ta, *tm
Data size	243 Mb
Data service system URL	http://dcc.cgs.gov.cn
Fund project	China Geological Survey Project "Mineral Survey and Prospecting Prediction of Integrated Exploration Areas of the Gold Deposits in the Shandong Zhaoyuan-Laizhou Area" (121201004000150017-60), a sub-subject of the project named Demonstration Project of Prospecting Prediction and Technical Application in Integrated Exploration Areas initiated by the Development and Research Center of the China Geological Survey (121201004000150017)
Language	Chinese
Database (dataset) composition	The dataset consists of an Excel file and an atlas. The Excel file consists of the original analysis data of 16 elements in 1 875 samples. The atlas comprises one mineralogical map, one sampling point bitmap and 16 element-specific geochemical maps.

as prior geological and geochemical data. The sampling points were deployed along first-order and second-order streams. One or more sampling points were additionally deployed for first-order streams with a length greater than 500 m. The catchment area covered by one sampling point was not less than 0.125 km^2 and not greater than 0.25 km^2, to ensure the uniformity of sampling points and also to avoid human influence.

2.2 Sampling Density

The design sampling density in general areas was 4 points per km^2, and it was appropriately increased in ore-controlling fracture zones and well-mineralized areas. The number of actual sampling points was 1 875, with an average sampling density of 4.5 points per km^2.

2.3 Sampling Method

In stream-bearing areas, the sampling points were arranged at the bottom of streams and gullies, or in places where alluvial diluvium of various size fractions tended to gather, such as places near flowing water, the inner banks of a stream channel bend, and fore edges of sand spits. Multi-point sampling was adopted to improve the representativeness of each sample, meaning that another 3 ~ 5 sampling points could be deployed within 30 meters of the original sampling point. The samples obtained from these sampling points were merged into a composite sample. In braided stream distribution areas, each sample was obtained by sampling from multiple parallel channels of one unit. In gullies or stream channels that are dry or where water only flows periodically, material of middle-small size fractions were collected in the stream bed, so that the interference caused by aeolian material could be eliminated.

When sampling was carried out in landscape areas with an obvious concave landform in continuous granite weathering residual areas, the water flow was determined according to the centerline of the concave landform. Then, 3 ~ 5 soil samples of equal quantity were collected in the negative topographic surface, with wide and gentle cross-sections on both sides along the water flow. The sampling was conducted in eluvium-diluvium-bearing areas. In small streams or piedmont streams without any obvious surface runoff, samples were effectively collected in larger streams in the runoff direction.

According to requirements, the weight of each original sample obtained from field sampling was more than 500g, the size fractions of samples collected were −10 ~ +80 mesh, and the final weight of each sample after sieving was more than 300g.

2.4 Sample Processing

The basic procedure of sample processing was as follows (Chen YM and Chen XF, 2018): naturaldrying→rubbing→sieving→thorough mixing→weighing→completinglabel→bottling→boxing→filling-in sample presentation form→warehousing.

(1) Dry the samples by natural sun and air drying. Rub and tap the samples with sticks frequently during sample drying in order to prevent caking. In rainy seasons, pay particular attention to the samples in order to prevent them from becoming scattered or contaminated due to rain, wind, sand, human factors, etc.

(2) Sieve the fully-dried samples with 10 mesh and 80 mesh stainless steel sieves successively. Only materials passing through the sieve, with a weight greater than 300g should be retained.

(3) Divide each original sample by the sample quartering method. Take 150g from the divided sample to form an analysis sample. Then pack the sample to be analyzed with kraft paper bags and plastic bottles. Take another 150g from the divided sample to form a duplicate sample of the analysis sample. Then pack the duplicate sample with bottles.

(4) Send the analysis samples to the Shandong Test Center of the China Metallurgical Geology Bureau for analysis and testing of the 16 elements. The duplicate samples are then kept in the Shandong Institute of Geological Survey in perpetuity.

3 Description of Data Samples

3.1 Data Characteristics

The geochemical dataset of the Area consists of an Excel file and an atlas. The Excel file, with the name of *1：50 000 Geochemical Analysis Data of the Biguo Map Sheet Area*, contains the original analysis data of the 16 elements including Au, Ag, Cu, Pb, Zn, As, Sb, Bi, Mo, Hg, Sn, W, Cd, Cr, Co and Ni from the 1 875 samples (Table 2). The atlas was named *1：50 000 Geochemical Atlas of the Biguo Map Sheet Area* and contains one mineralogical map, one sampling point bitmap and the geochemical maps of the 16 elements (Fig. 2).

Table 2 Element Geochemical Analysis Data in Biguo Map Sheet Area

S.N.	Name	Data type	Example	S.N.	Name	Data type	Example
1	Batch No. to be analyzed	Char	HF2016-240	11	Bi	Float	0.22
2	Lab No.	Char	F201616461	12	Mo	Float	0.70
3	Sample No.	Char	1d1	13	Hg	Float	17.6
4	Au	Float	2.79	14	Sn	Float	1.06
5	Ag	Float	0.11	15	W	Float	0.76

Continued table 2

S.N.	Name	Data type	Example	S.N.	Name	Data type	Example
6	Cu	Float	23.6	16	Cd	Float	0.10
7	Pb	Float	20.9	17	Cr	Float	62.4
8	Zn	Float	55.9	18	Co	Float	17.4
9	As	Float	4.30	19	Ni	Float	23.2
10	Sb	Float	0.48				

Note: units are included in elements: the unit of Au and Hg is 10^{-9}, and the unit of other elements are 10^{-6}.

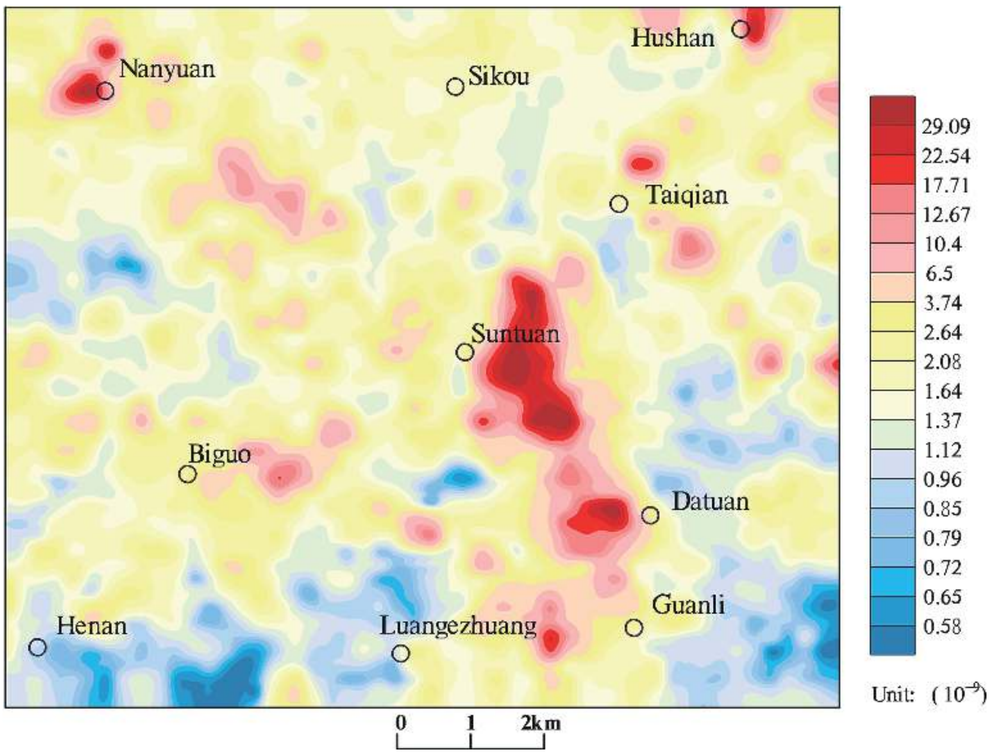

Fig. 2 Geochemical map of the element gold in the Area

3.2 Geological Characteristics and Zoning

The main geological bodies exposed in the Area are archaean and mesozoic intrusive rocks. The Archaean intrusive rocks, from early metamorphic pyroxenite to late tonalitic gneiss, reflect the fact that the mantle-derived ultramafic-mafic magma and mafic magma intruded upwards in the early tensile environment and the mantle-derived magma was mixed with crust-derived material while it partially differentiated in the late aggregation environment. In this way, the Qixia gneiss sequence was formed (Wang SJ et al., 2009).

Extensive tectonic activities took place in the late stage of the Mesozoic Yanshanian period, including mantle-derived basal magma intruding upwards in a tensile environment, plate collision, orogenetic granite formation, and the metasomatism of crustal mantle-derived materials under the extension regime after orogenesis. Therefore, the Linglong granite is formed due to remelting of the upper crust.

The Neogene System is characterized by deposits resulting from a large-scale volcanic eruption. In order to understand the distribution pattern of the elements in different geological bodies, the whole area was divided into three geological sub-areas according to the lithological differences (see Fig. 3), specifically, the Quaternary alluvium sub-area (Q), the Jurassic adamellite sub-area (J), and the Archean gneiss system sub-area (Ar).

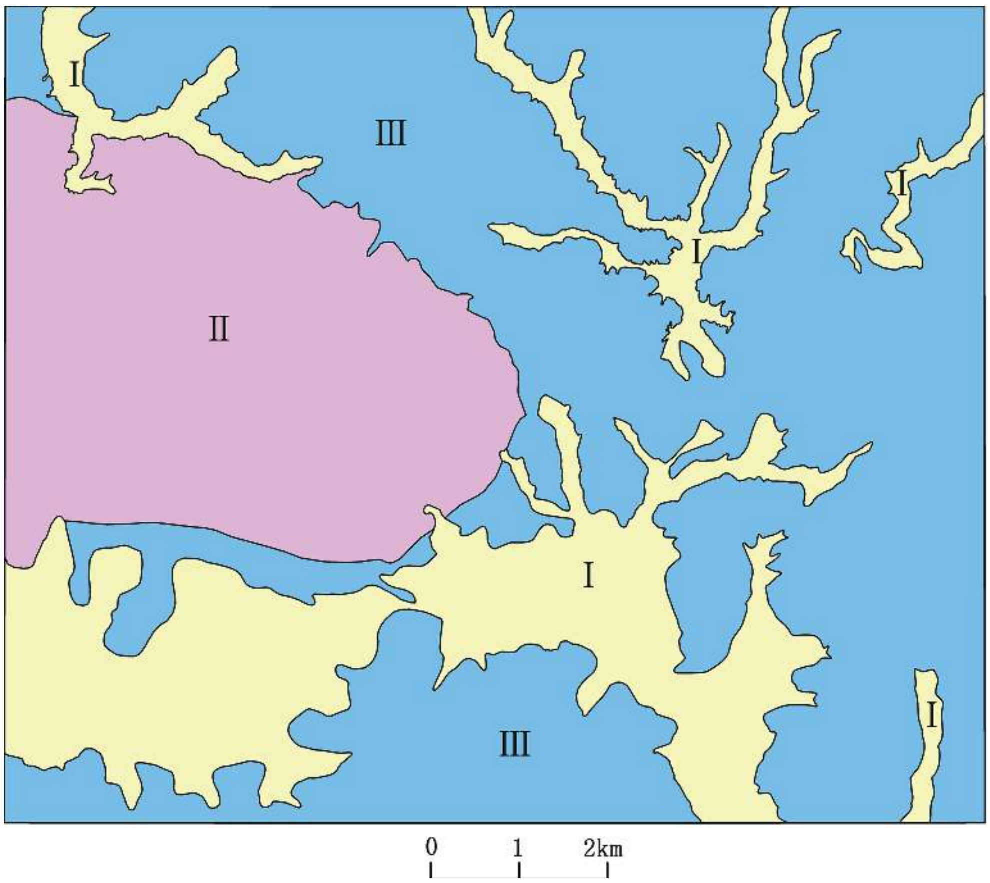

Fig. 3 Geological sub-area zoning in the Area

Ⅰ Quaternary alluvium; Ⅱ Jurassic adamellite; Ⅲ Archean gneiss system

3.3 Elemental Geochemical Characteristics

Statistics were produced of parameters of characteristic values of various elements in the Area and three geological sub-areas, in order to reflect the distribution characteristics of the elements in different geological sub-areas of the Area, and the geochemical processes related to geological metallogenicity (Table 3).

As can be seen from Table 3, the Archean gneiss system sub-area (Ar) content of multiple elements in stream sediments is significantly higher than in the whole Area, especially significantly higher is the content of siderophile elements such as Ni, Co, Cu, Cr and Zn. In this way, important sources for metallogenic material in the Area were provided. The content of five elements, including Ag, As, Sn, Bi and Mo, was equivalent to the average content of these elements in the whole area. Although the content of the Pb element in the stratum of this sub-area was lower than the average content of Pb in the whole area, the deviation and the variation coefficient were high and were obviously higher than those in other areas of Shandong Province. Therefore, it is also possible for Pb to be formed locally in tectonic development areas. In the Jurassic adamellite sub-area (J), the content of the measured elements in stream sediments is generally lower than the average content of the elements in the whole area, which reflects different enrichment characteristics to the Neogene. However, the content of the Pb and Cd elements is slightly higher than the average value of Pb and Cd in the whole area, and the dispersion degree of Pb and Cd is high. This indicates that this sub-area may become an important area for the metallogenicity of Pb and Cd. In the Quaternary sedimentary sub-area (Q), Au, Ag, Mo, Cd, As, W, Hg and Sb elements were enriched and especially the Clarke concentration values of As, Cd, Sb, etc. were all greater than 1. This indicates that these elements were transported smoothly in stream sediments after these elements had undergone weathering along the water catchment areas and reflects the distribution characteristics of geochemical elemental content of the original rocks in the sub-area.

Table 3 Comparison of Parameters of Characteristics of the Elements in Sub-Areas of the Area

Mean value ($\bar{X}$)Geological sub-area	Au	Ag	Cu	Pb	Zn	As	Sb	Bi
Q	3.855	0.091	26.582	19.828	49.895	5.05	0.456	0.179
J	2.75	0.057	12.395	29.351	38.703	2.787	0.409	0.158
Ar	4.335	0.093	36.514	19.31	61.874	4.3	0.441	0.222
Whole area	3.83	0.085	29.076	22.054	54.766	4.254	0.444	0.2
Mean value ($\bar{X}$)Geological sub-area	**Mo**	**Hg**	**Sn**	**W**	**Cd**	**Cr**	**Co**	**Ni**
Q	0.545	16.718	1.353	0.867	0.104	47.798	11.629	21.768
J	0.363	9.101	1.282	0.519	0.057	24.963	5.24	11.516
Ar	0.584	17.635	1.43	0.909	0.118	64.641	16.693	31.406
Whole area	0.536	15.46	1.406	0.818	0.102	52.288	13.226	25.052

Note: “X” in the table is the arithmetical mean value of each sub-area or the whole area in the Area; Lithology: Ar- Archean gneiss system sub-area, J- Jurassic adamellite sub-area, Q- Quaternary alluvium sub-area. Among these parameters, the unit of Au, Hg is 10^{-9} and the unit of the remaining elements is 10^{-6}.

4 Data Quality Control and Assessment

16 elements were analyzed and tested by the Shandong Bureau Test Center of the China Metallurgical Geology Bureau. The elements included Au, Ag, Cu, Pb, Zn, As, Sb, Bi, Mo, Hg, Sn, W, Cd, Cr, Co and Ni. The analysis methods included inductively coupled plasma mass spectrometry (ICP-MS), atomic fluorescence spectrometry (AFS), powder emission spectrometry (ES), and graphite furnace atomic absorption spectrometry (GF-AAS). Among these methods, the first two methods play a key role, the remaining two methods having a subsidiary role. The analysis method and its detection limits, the detection limit required by the *Specifications for Geochemical Reconnaissance Surveys* (*1 ∶ 50 000*) (DD2009-xx) - also referred to as “the Specification” - and the reported rate of each element is shown in Table 4.

The combination of external quality monitoring and internal quality monitoring was adopted for quality management, with external quality monitoring as the primary criterion. In terms of the external quality monitoring, standard control samples were inserted at a proportion of 4% and 80 control samples were inserted in total. As for the internal quality monitoring, every 50 analysis samples constituted an analytical group, and four primary certified reference materials of stream sediments were inserted, specifically, As, Sb, Hg (GSS-8, GSD-9, GSD-10, and GSD-14), Co, Cr, Cu, Zn, Mo, Sn, Pb, W, Bi, Ni, Cd (GSS-8, GSD-9, GSD-10, and GSD-14), and Ag (GSS-8, GSD-9, GSD-10, GSD-14). With each batch as a statistical unit, the logarithmic difference $\Delta \lg C$ between the measured value and the standard value of the primary certified reference material or the monitoring sample of each element was calculated separately, in order to control the accuracy of the analysis. In addition, the standard deviation (λ) of the average logarithmic difference of four primary certified reference materials of each element was calculated, to measure the precision of the samples of the same batch.

Table 4 Detection Limits of the Analytical Methods and the Reported Rates of the Elements Under Analysis

Element No.	Element detected		Detection limit of analysis method	Detection limit required by the Specification	Reported rate (%)	Analysis method
1	Au	Gold	0.000 3	0.000 3	98.7	GF-AAS
2	Ag	Silver	0.02	0.03	99.62	ES
3	Cu	Copper	0.5	1.5	99.9	ICP-MS
4	Pb	Lead	0.5	5	99.9	ICP-MS
5	Zn	Zinc	1	15	99.95	ICP-MS
6	As	Arsenic	0.2	1	99.52	AFS
7	Sb	Antimony	0.1	0.2	99.9	AFS
8	Bi	Bismuth	0.02	0.1	99.86	ICP-MS
9	Mo	Molybdenum	0.05	0.5	100	ICP-MS
10	Hg	Mercury	0.005	0.005	93.28	AFS
11	Sn	Stannum	0.2	1	100	ICP-MS
12	W	Tungsten	0.05	0.5	99.86	ICP-MS
13	Cd	Cadmium	0.03	0.1	98.18	ICP-MS
14	Cr	Chromium	2	15	99.9	ICP-MS
15	Co	Cobalt	0.1	1	99.95	ICP-MS
16	Ni	Nickel	0.5	3	100	ICP-MS

Legend: inductively coupled plasma mass spectrometry (ICP-MS), powder emission spectrometry (ES), atomic fluorescence spectrometry (AFS), and graphite furnace atomic absorption spectrometry (GF-AAS)

Quality monitoring of Au element analysis was performed as follows. With 50 samples as a statistical unit, five primary certified reference materials (GAu2b, GAu7a, GAu9b, GAu11a, and GAu12) with content of 0.86, 3.1, 1.5, 10.5, and 20.8 respectively were inserted into each statistical unit. Then the statistical unit was taken as a monitoring sample for gold analysis.

Quality monitoring of internal inspection samples and abnormal points was undertaken as follows. Internal inspection covered 8% of total samples and spot-checks were conducted on the samples with abnormally high or low element content. For the quality monitoring of internal inspection analysis and abnormal spot-checks of each element, relative deviation |RD%| less than or equal to 25% was taken as the criterion of a statistically qualifying rate, with the criterion for first-time qualifying rate being greater than or equal to 90%.

The qualifying rate of the 16 elements of all the monitoring samples was 100%. About 8% of the total samples were randomly selected for internal inspection, with a total number of 166 internal inspection samples, a total number of 2 656 internal inspection items, and a qualifying rate for internal inspection of 99.13%.

In order to avoid geochemical distortions caused by accidental analytical errors, repetitive inspection was carried out for the analysis results with high mutation or low mutation after the analysis of each batch of samples. The total number of abnormal spot-check items was 1 440, with 1 440 total qualified items and a qualifying rate of 100%. The total qualifying rate of internal inspection and abnormal spot-checks was 99.44%.

5 Data Processing

SPSS 19.0 software from IBM was adopted for data processing, and GeoIPAS V3.2, geoscience application software from a company named JWSOFT in Xinjiang, was utilised for mapping.

(1) Data processing

For the original dataset of the 16 elements in the Area, the outlier data were eliminated by loops and iterations with criteria of ($\bar{x}$±3S) until no further outlier numerical value could be eliminated. Therefore, the background dataset was obtained. Then the threshold (T) was calculated based on the global average of eliminated outlier data ($\bar{x}$) and the standard deviation (S). The calculation formula was T=$\bar{x}$+2S.

(2) Data gridding

With a grid interval of 250 m × 250 m and a search radius of 1 250 × 1 250, data gridding was conducted with the parameters of a power exponential weighted model.

(3) Drawing of geochemical element maps

The seven-level color gradation method stipulated by the China Geological Survey was adopted for isoline color regions. The maps were achieved by drawing contour lines with corresponding color content intervals. The intervals of different contour lines in each color gradation were represented by transition color gradations, and the gradient effect was achieved by related zones in the same color gradation. The corresponding color regions gradually transitioned as follows: dark blue (relatively low value zone) → blue (low value zone) → light blue (low background zone) → light yellow (background zone) → light red (high background zone) → red (high value zone) →dark red (relatively high value zone).

(4) Quality assurance

100% review was conducted during transcription, map drawing and calculation of all the original data in the map preparation and data collation.

6 Delineation and Characteristics of Anomalies

(1) Anomaly delineation

There were three types of composite anomalies according to the characteristics of the element associations in the Area, specifically, a composite anomaly of Au, As, Sb and Hg, a composite anomaly of Cu, Zn, Cr, Co and Ni, and a composite anomaly of W, Sn, Bi, Pb and Ag. According to the composite anomalies as well as the area, intensity and geoenvironmental factors, anomalies were delineated in the areas where anomalies could be seen to have obvious relationships with the superimposed geological environment, metallogenesis, and geological space. Anomalies with a poor abnormal association of elements and poor metallogenic geological conditions were selectively eliminated, according to experience. As for individual single element anomalies with a large distribution area, they were partitioned artificially at weak joints or typical watersheds by taking geological conditions and the boundary of element association into comprehensive consideration. Thus, integrated anomalies were obtained. A total of 10 integrated anomalies in the whole Area were delineated.

(2) General characteristics of anomalies

The main anomaly zones in the Area were consistent with the regional structure as a whole. In the northeast of the Area, the anomaly zones are mainly distributed in a NE-trending banded mode. The Hushan-Taiqian anomaly zone, Suntuan anomaly zone, and Sansukuang anomaly zone are successively distributed from NE trending to SW trending. In the south of the Area, the Biguo anomaly zone is mainly distributed in a nearly EW-trending banded mode.

In terms of the geological background to the anomaly distribution, the NE-trending anomaly zones are distributed along the Taiqian-Douya fracture zone (Liao MW et al., 2014; Xu F, 2008). In these anomaly zones, the Xinzhuang units of the Neoarchean Qixia sequence and the Mujia units of the Tangezhuang sequence have mainly developed, and in addition, a small number of Dawujia and Luanjiazhai units of the Malianzhuang sequence are formed in gneiss as inclusions of various sizes (Wang SJ et al., 2009). According to geophysical prospecting, the zone is characterized by high magnetism and low gravity. According to remote sensing, the zone enjoys dense alteration anomaly information, the distribution being consistent with the structure, and a high extraction rate of information.

The Hushan-Taiqian anomaly zone is a composite anomaly of Au, Bi, Hg, Ag, W, Mo, Cd, As, Sn, Sb and Cu with Au acting as the dominant element. The anomaly zone is distributed in a NE-trending irregular rectangle, with an anomaly area of about 12.71 km^2 and a high anomaly concentration. In terms of Au anomalies, there are multi-point inner-zone anomalies and two anomaly concentration centers with an anomaly peak value of 345×10^{-9}. The Hushan gold deposit and the Taiqian gold deposit have been discovered in the zone.

The Suntuan anomaly zone is a composite anomaly of Ag, Cd, Cu, Mo, Pb, Bi, As, Sb and Hg, with Au acting as the dominant element. The anomaly is distributed in a NW-trending irregular rectangle with a high anomaly concentration. 21 concentration sub-zones of Au, Mo, Ag, Bi, Cd, W and Hg have developed in this zone, with three concentration sub-zones of each element. The Au anomaly area is 12.98 km^2 with a peak value of 190×10^{-9}. The Suntuan gold deposit and the Daheya gold deposit have been developed in the zone.

The Sansukuang anomaly zone is a composite anomaly of Ag, Hg, Zn, Pb, Ni, Cu, Cr, Co and Cd, with Au also acting as the dominant element. The anomaly is NE-trending, and distributed irregularly, with an anomaly area of about 4.802 km^2 and a high anomaly concentration. Three concentration sub-zones of Au have developed with an anomaly area of 2.41 km^2 and a peak value of 29.4×10^{-9}. The centres of the anomaly concentration of the elements overlap well, and various anomaly associations of elements exist. One gold occurrence has been developed in the zone.

The nearly EW-trending anomaly zones are distributed along the Biguo fracture zone. The fracture zone is formed in and near the contact zone between the Biguo granite and the gneiss of the archaean Xinzhuang unit, with good congruence of Au, Ag, Pb, and Zn and a high anomaly concentration. The centres of the anomaly concentrations of the elements overlap well. According to geophysical prospecting, the nearly EW-trending zones are characterized by low gravity and high moniliform magnetism. According to remote sensing, the nearly EW-trending zones are unusually dense in interpretation data, the distribution is consistent with the structure, and a high extraction ratio of alteration anomalies. One gold occurrence and two mineralized spots exist in the zone.

7 Conclusion

The 1∶50 000 stream sediment measurement of the Area was conducted by the Shandong Institute of Geological Survey and the Geological Exploration Institute of Shandong Zhengyuan, Chinese Metallurgical Geology Bureau. The measurement took place over nearly three years and valuable first-hand geochemical survey data, as well as the geochemical atlas prepared based on the first-hand data, were obtained.

Through the measurement, the data used to objectively reflect the distribution patterns of the elements in the Area, as well as the geological and mineralogical information of the Area, was procured, and a batch of geochemical anomalies with prospecting value were delineated, thus providing reliable geochemical information for prospecting in the Area.

Through mineralogical survey work, the formation sequence, genesis and emplacement mechanism of the intrusive rocks in the Area were clarified; and the metallogenic geological bodies and metallogenic structures, as well as the characteristics of the metallogenic process in the Area, were summarized. Five gold prospecting target areas were further delineated by combining geological, geophysical, geochemical, remote sensing and mineral characteristics.

The establishment of the Dataset provides a set of basic data resources for the Area, and thus challenges other researchers for measurement information of stream sediments in the Area to be met to the maximum extent, so contributing to the realization of information and resource sharing.

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