

《中文核心期刊》  
《中国学术期刊综合评价数据库》(CAJCED) 来源期刊  
《中国科技论文统计源期刊》数据库来源期刊  
《中文科技期刊数据库》来源期刊  
《万方数据-数字化期刊群》入网期刊  
《中国期刊全文数据库》(CJFD) 全文收录期刊  
《中国学术期刊(光盘版)》入编期刊  
《中文电子期刊服务资料库》(CEPS) 收录期刊  
美国《化学文摘》(CA) 来源期刊  
俄罗斯《文摘杂志》(PЖ) 来源期刊  
美国《地质光盘数据库》(GeoRef) 收录期刊

## 物 探 与 化 探

双月刊 1979 年 2 月创刊  
2022 年 6 月 第 46 卷 第 3 期

## GEOPHYSICAL & GEOCHEMICAL EXPLORATION

Bimonthly, Started in 1979  
Vol.46 No.3 Jun., 2022

**主管** 中国地质调查局  
**主办** 中国自然资源航空物探遥感中心  
**编辑** 《物探与化探》编辑部  
地址:北京学院路 29 号航遥中心  
邮编:100083  
电话:(010)62060192;62060193  
传真:(010)62060193  
E-mail:whbjb@sina.com  
<http://www.wutanyuhuatan.com>

**主编** 熊盛青  
**出版** 地质出版社  
(北京学院路 31 号)  
**印刷** 北京宝隆世纪印刷有限公司  
**总发行** 北京市邮政局  
**国外发行** 中国国际图书贸易总公司  
(北京 399 信箱)  
国外发行代号 BM5551

**订 阅** 全国各地邮局  
**广告许可证** 京海市监广登字 20210016 号

**Superintended by** China Geological Survey  
**Sponsored by** China Aero Geophysical Survey and Remote Sensing Center for Natural Resources  
**Edited by** Editorial Office of Geophysical and Geochemical Exploration  
Add:29 Xueyuan Road, Beijing 100083, China  
Tel:86-010-62060192/62060193  
Fax:86-010-62060193  
E-mail:whbjb@sina.com  
Web:<http://www.wutanyuhuatan.com>  
**Editor in Chief** XIONG Sheng-Qing  
**Published by** The Geological Publishing House  
(31 Xueyuan Road, Beijing 100083, China)  
**Printer** Beijing Baolongshiji Printing Co. Ltd.  
**Distributor** Beijing Post Office  
**Abroad Distributor** China International Book Trading Corporation  
**Subscription Hander** Local Post Offices of China

《全域地球物理探测与智能感知》专栏

|                                              |                        |       |
|----------------------------------------------|------------------------|-------|
| 海洋可控源电磁发射系统中的绝缘在线监测技术研究 .....                | 邓明,王猛,吴雯,马晓茜,罗贤虎       | (537) |
| MicrOBEM:小型海底电磁接收机 .....                     | 罗贤虎,邓明,邱宁,孙珍,王猛,景建恩,陈凯 | (544) |
| 海底电磁接收机的通道标定计算程序 .....                       | 乔玉,陈凯,阳琴               | (550) |
| 页岩气水力压裂分布式微弱电场监测技术初探 .....                   | 吴雯,王猛,杨迪琨,陈默,任林彬       | (557) |
| 直流电阻率法与工作面透明化 .....                          | 饶荣富,苏本玉                | (563) |
| 地震勘探节点采集系统设计的要点 .....                        | 岩巍                     | (570) |
| 重力及其梯度异常正演的 Moving-footprint 大尺度模型分解方法 ..... | 石泽玉,张志厚,刘鹏飞,范祥泰        | (576) |

地质调查·资源勘查

|                                                 |                                 |       |
|-------------------------------------------------|---------------------------------|-------|
| 岩屑地球化学测量在甘肃北山干旱戈壁荒漠区的找矿效果——以三白墩地区金矿矿的发现为例 ..... | 雷自强,陈杰,陈世明,方成豪,杨镇熙,王振           | (585) |
| 隐伏岩浆型铜镍矿空一地一井协同勘查技术体系 .....                     | 黄旭钊,范正国,何敬梓,葛藤菲,王思浔,满毅,王鹏,李军,王恒 | (597) |
| 彭水地区碳酸盐岩山地地震激发接收因素优选及效果 .....                   | 薛野,杨帆,刘厚裕,刘明,赵苏城,蓝加达            | (608) |
| 三维 AMT 正反演技术对贵州马坪含金刚石岩体探测的精细解释 .....            | 何帅,杨炳南,阮帅,李永刚,韩姚飞,朱大伟           | (618) |
| 中国陆域冻土区浅表烃类地球化学特征及其成因分析 .....                   | 杨志斌,周亚龙,张富贵,张舜尧,孙忠军             | (628) |
| 矿物自动分析系统在碳酸岩型稀土地球化学勘查中的应用 .....                 | 刘东盛,陈圆圆                         | (637) |
| 基于叠前同时反演的致密砂岩储层预测及含气性识别——以苏里格 S 区块为例 .....      | 张德明,刘志刚,臧殿光,廖显锋,刘志毅,刘国宝         | (645) |
| 基于 MRAS 证据权重模型的河南老湾地区金矿成矿预测 .....               | 魏从玲,陈建立,郭鹏                      | (653) |
| 西北某石英脉型金矿综合物探特征及定量解释实例 .....                    | 冯军,蒋文,张征                        | (661) |
| 复电阻率法在安徽南陵盆地海相页岩气勘探中的应用 .....                   | 殷启春,王元俊,周道容,张丽,孙桐               | (668) |
| 油气微生物对顺北断溶体油藏的近地表响应 .....                       | 曹飞,杨敏,鲍典,陈银节,王国建                | (678) |
| 地下方形空洞地质雷达成像机理研究 .....                          | 韩佳明,牛宇凯,刘明明,郭亚南,金超              | (685) |

方法研究·信息处理·仪器研制

|                                         |                            |       |
|-----------------------------------------|----------------------------|-------|
| 多源并发下 Mur 二阶吸收边界和非分裂递归卷积完全匹配层对比研究 ..... | 崔凡,陈毅,薛晗鹏,彭苏萍,杜云飞          | (693) |
| Shearlet 域尺度角度自适应深反射地震数据随机噪声压制方法 .....  | 王通,刘建勋,王兴宇,李广才,田密          | (704) |
| 免维护超低噪声固体不极化电极的研制与性能测试 .....            | 王辉,付书计,葛帅寅,马方圆,宋宝家,罗景程     | (714) |
| 时间域激电测深不同装置数据去耦分析 .....                 | 李忠平,郝风云,吴鸿飞,张瑞芳,朱昭明,贾全山,刘双 | (722) |
| 基于组合震源编码的多尺度全波形反演方法 .....               | 国运东                        | (729) |
| 基于电阻率测井曲线的大地电磁测深的标定 .....               | 赵理芳,李爱勇,王导丽,张明鹏,周锡明        | (737) |
| 基于 Python 语言的瑞利面波频散反演实行方案 .....         | 吴为治,娄利,王鹏,王宾               | (743) |

生态环境调查

|                                  |                                   |       |
|----------------------------------|-----------------------------------|-------|
| 安徽省宣城市土壤硒地球化学特征及成因分析 .....       | 邢润华                               | (750) |
| 云南省安宁地区土壤重金属等元素生态地球化学调查与评价 ..... | 范晨子,袁继海,刘成海,郭威,孙冬阳,刘崴,赵九江,胡俊栋,赵令浩 | (761) |
| 青海省富硒土壤标准探讨 .....                | 马强,张亚峰,黄强,姬丙艳,苗国文,马凤娟,马瑛          | (772) |
| 海河流域沉积物重金属形态分布特征及生态风险评估研究 .....  | 李生清                               | (781) |

|                                                                                                                                                                                                                      |                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Online insulation monitoring technology for a marine controlled source electromagnetic transmitter system</b>                                                                                                     |                                                                                                                                  |
| ..... DENG Ming, WANG Meng, WU Wen, MA Xiao-Xi, LUO Xian-Hu                                                                                                                                                          | (537)                                                                                                                            |
| <b>MicroOBEM: a micro-ocean-bottom electromagnetic receiver</b>                                                                                                                                                      |                                                                                                                                  |
| ..... LUO Xian-Hu, DENG Ming, QIU Ning, SUN Zhen, WANG Meng, JING Jian-En, CHEN Kai                                                                                                                                  | (544)                                                                                                                            |
| <b>Channel calibration calculation program for OBEMs</b>                                                                                                                                                             | ..... QIAO Yu, CHEN Kai, YANG Qin (550)                                                                                          |
| <b>Preliminary exploration into the monitoring technology for distributed weak electric field during hydraulic fracturing for shale gas extraction</b>                                                               | ..... WU Wen, WANG Meng, YANG Di-Kun, CHEN Mo, REN Lin-Bin (557)                                                                 |
| <b>Direct current resistivity method and the transparency of mining face</b>                                                                                                                                         | ..... RAO Rong-Fu, SU Ben-Yu (563)                                                                                               |
| <b>Key points of the design of a nodal acquisition system for seismic exploration</b>                                                                                                                                | ..... YAN Wei (570)                                                                                                              |
| <b>Moving-footprint-based large-scale model decomposition method for forward modeling of gravity and gravity gradient anomalies</b>                                                                                  | ..... SHI Ze-Yu, ZHANG Zhi-Hou, LIU Peng-Fei, FAN Xiang-Tai (576)                                                                |
| <b>Application of geochemical survey of lithic fragments in ore prospecting in arid Gobi desert of the Beishan area, Gansu Province: A case study of the discovery of the gold-arsenic deposit in Sanbaidun area</b> | ..... LEI Zi-Qiang, CHEN Jie, CHEN Shi-Ming, FANG Cheng-Hao, YANG Zhen-Xi, WANG-Zhen (585)                                       |
| <b>A collaborative airborne, ground, and borehole exploration technology system for concealed magmatic copper-nickel deposits</b>                                                                                    | ..... HUANG Xu-Zhao, FAN Zheng-Guo, HE Jing-Zi, GE Teng-Fei, WANG Si-Xun, MAN Yi, WANG Peng, LI Jun, WANG Heng (597)             |
| <b>Determination of the optimal factors of seismic excitation and reception on the ground surface of carbonate mountainous areas in Pengshui area and its seismic acquisition effects</b>                            | ..... XUE Ye, YANG Fan, LIU Hou-Yu, LIU Ming, ZHAO Su-Cheng, LAN Jia-Da (608)                                                    |
| <b>Fine Interpretation of the exploration results of diamond-bearing rock masses in Mapping area, Guizhou using the 3D AMT forward modeling and inversion technologies</b>                                           | ..... HE Shuai, YANG Bing-Nan, RUAN Shuai, LI Yong-Gang, HAN Yao-Fei, ZHU Da-Wei (618)                                           |
| <b>Geochemical characteristics and genesis of hydrocarbons in superficial soil in continental permafrost regions in China</b>                                                                                        | ..... YANG Zhi-Bin, ZHOU Ya-Long, ZHANG Fu-Gui, ZHANG Shun-Yao, SUN Zhong-Jun (628)                                              |
| <b>Application of automated mineral analysis systems in geochemical exploration of carbonatite-related REE deposits</b>                                                                                              | ..... LIU Dong-Sheng, CHEN Yuan-Yuan (637)                                                                                       |
| <b>Prediction and identification of gas-bearing properties of tight sandstone reservoirs through simultaneous pre-stack inversion: A case study of block S in Sulige gas field</b>                                   | ..... ZHANG De-Ming, LIU Zhi-Gang, ZANG Dian-Guang, LIAO Xian-Feng, LIU Zhi-Yi, LIU Guo-Bao (645)                                |
| <b>Metallogenic prediction of gold deposits in Laowan area, Henan Province using the weight of evidence model and MRAS</b>                                                                                           | ..... WEI Cong-Ling, CHEN Jian-Li, GUO Peng (653)                                                                                |
| <b>An instance of comprehensive geophysical prospecting features and quantitative interpretation of a quartz-vein-type gold deposit in Northwest China</b>                                                           | ..... FENG Jun, JIANG Wen, ZHANG Zheng (661)                                                                                     |
| <b>Application of complex resistivity method to the exploration of marine shale gas in the Nanling Basin, Anhui Province</b>                                                                                         | ..... YIN Qi-Chun, WANG Yuan-Jun, ZHOU Dao-Rong, ZHANG Li, SUN Tong (668)                                                        |
| <b>Near-surface response of hydrocarbon-consuming microorganisms to the fault-karst reservoirs in Shunbei oil and gas field</b>                                                                                      | ..... CAO Fei, YANG Min, BAO Dian, CHEN Yin-Jie, WANG Guo-Jian (678)                                                             |
| <b>Ground penetrating radar imaging mechanisms of underground square cavities</b>                                                                                                                                    | ..... HAN Jia-Ming, NIU Yu-Kai, LIU Ming-Ming, GUO Ya-Nan, JIN Chao (685)                                                        |
| <b>A comparative study of Mur second-order absorbing boundary condition and unsplit recursive convolutional perfectly matched layer method under multi-source concurrency</b>                                        | ..... CUI Fan, CHEN Yi, XUE Han-Peng, PENG Su-Ping, DU Yun-Fei (693)                                                             |
| <b>Suppression of random noise in deep seismic reflection data using adaptive threshold-based Shearlet transform</b>                                                                                                 | ..... WANG Tong, LIU Jian-Xun, WANG Xing-Yu, LI Guang-Cai, TIAN Mi (704)                                                         |
| <b>Development and performance tests of maintenance-free ultra-low noise solid nonpolarizing electrodes</b>                                                                                                          | ..... WANG Hui, FU Shu-Ji, GE Shuai-Yin, MA Fang-Yuan, SONG Bao-Jia, LUO Jing-Cheng (714)                                        |
| <b>A data decoupling analysis of different devices in time-domain IP sounding</b>                                                                                                                                    | ..... LI Zhong-Ping, HAO Feng-Yun, WU Hong-Fei, ZHANG Rui-Fang, ZHU Zhao-Ming, JIA Quan-Shan, LIU Shuang (722)                   |
| <b>Multi-scale full waveform inversion method using combined source encoding</b>                                                                                                                                     | ..... GUO Yun-Dong (729)                                                                                                         |
| <b>Calibration of magnetotelluric sounding based on resistivity logging curves</b>                                                                                                                                   | ..... ZHAO Li-Fang, LI Ai-Yong, WANG Dao-Li, ZHANG Ming-Peng, ZHOU Xi-Ming (737)                                                 |
| <b>A Python-based scheme of Rayleigh-wave dispersion inversion</b>                                                                                                                                                   | ..... WU Wei-Zhi, LOU Li, WANG Peng, WANG Bin (743)                                                                              |
| <b>Geochemical characteristics and genesis of selenium in soil in Xuancheng City, Anhui Province</b>                                                                                                                 | ..... XING Run-Hua (750)                                                                                                         |
| <b>Eco-geochemical survey and evaluation of heavy metals and other elements in soil in Anning City, Yunnan Province</b>                                                                                              | ..... FAN Chen-Zi, YUAN Ji-Hai, LIU Cheng-Hai, GUO Wei, SUN Dong-Yang, LIU Wei, ZHAO Jiu-Jiang, HU Jun-Dong, ZHAO Ling-Hao (761) |
| <b>Exploring the standards of Se-rich soil in Qinghai Province</b>                                                                                                                                                   | ..... MA Qiang, ZHANG Ya-Feng, HUANG Qiang, JI Bing-Yan, MIAO Guo-Wen, MA Feng-Juan, MA Ying (772)                               |
| <b>Speciation and distribution of heavy metals in sediments in Haihe River Basin and their effects on ecological risk assessment</b>                                                                                 | ..... LI Sheng-Qing (781)                                                                                                        |