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Indexing in Scopus and Web of Science ensures high international visibility of publications, promotes citation growth, and reflects the editorial board's commitment to publishing relevant, original, and scientifically significant research in the fields of geology and technical sciences.

«Қазақстан Республикасы Ұлттық ғылым академиясының Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналы 2016 жылдан бастап халықаралық реферативтік және ғылымиметриялық Scopus дерекқорында индекстеледі және тұрақты библиометриялық көрсеткіштерді көрсетіп келеді.

Сонымен қатар журнал Web of Science платформасының (Clarivate Analytics, 2018) халықаралық реферативтік және наукометриялық дерекқоры Emerging Sources Citation Index (ESCI) тізіміне енгізілген.

ESCI дерекқорында индекстелуі журналдың халықаралық ғылыми рецензиялау талаптары мен редакциялық этика стандарттарына сәйкестігін растайды, сондай-ақ Clarivate Analytics компаниясы тарапынан басылмды Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI) және Arts & Humanities Citation Index (AHCI) дерекқорларына енгізу қарастырылуда.

Scopus және Web of Science дерекқорларында индекстелуі жарияланымдардың халықаралық деңгейде жоғары сұранысқа ие болуын қамтамасыз етеді, олардың дәйексөз алу көрсеткіштерінің артуына ықпал етеді және редакциялық алқаның геология мен техникалық ғылымдар саласындағы өзекті, бірегей және ғылыми тұрғыдан маңызды зерттеулерді жариялауға ұмтылысын айқындайды.

Научный журнал «News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences» с 2016 года индексируется в международной реферативной и наукометрической базе данных Scopus и демонстрирует стабильные библиометрические показатели.

Журнал также включён в международную реферативную и наукометрическую базу данных Emerging Sources Citation Index (ESCI) платформы Web of Science (Clarivate Analytics, 2018).

Индексирование в ESCI подтверждает соответствие журнала международным стандартам научного рецензирования и редакционной этики, а также рассматривается компанией Clarivate Analytics в рамках дальнейшего включения издания в Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI) и Arts & Humanities Citation Index (AHCI).

Индексирование в Scopus и Web of Science обеспечивает высокую международную востребованность публикаций, способствует росту цитируемости и подтверждает стремление редакционной коллегии публиковать актуальные, оригинальные и научно значимые исследования в области геологии и технических наук.

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POSSIBILITIES OF MERCURY STUDIES IN SEISMIC HAZARD ASSESSMENT AND EARTHQUAKE FORECASTING

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Abstract. Since the mid-1960s, research aimed at identifying earthquake precursors has been conducted in many countries. The identification of reliable earthquake precursors and the development of medium- and short-term forecasts of earthquake timing and location remain important scientific challenges. Mercurymetric methods have been applied in geological exploration since the second half of the twentieth century and have demonstrated their effectiveness in detecting concealed and buried geological objects. Mercury is characterised by low chemical reactivity in both oxidative and reductive environments and exhibits lower chemical activity compared to most chemical elements. The unique physicochemical properties of mercury, particularly its high migration capacity combined with relative inertness to other gases, make it suitable for application in short-term earthquake forecasting and tectonic fault mapping. Measurements of mercury concentrations in borehole waters, atmospheric air, soil gas, surface waters and groundwater in seismically active regions reveal anomalous variations prior to earthquakes and during the aftershock stage. Modelling studies suggest that mercury release from rocks is directly related to mechanical (geodynamic) stresses occurring during earthquake preparation and seismic events. A review of previous studies on mercury concentrations in environmental media within seismically active zones indicates the considerable potential of mercurymetric methods for

addressing seismological problems. The availability of modern mercurymetric instrumentation enables the determination of ultralow mercury concentrations in various environmental components, supporting the feasibility of this approach.

Keywords: mercurymetry, mercury concentration, tectonic faults, fault mapping, soil gas, near-surface atmosphere, groundwater, earthquake prediction, earthquake precursors

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СЕЙСМИКАЛЫҚ ҚАУІПТІ БАҒАЛАУ ЖӘНЕ ЖЕР СІЛКІСІН БОЛЖАУДА СЫНАП-МЕТРИКАЛЫҚ ЗЕРТТЕУДІҢ МҮМКІНДІКТЕРІ

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Аннотация. Өткен ғасырдың 60-жылдарының екінші жартысынан бастап көптеген елдерде жер сілкінісінің ізашарларын анықтауға бағытталған зерттеулер жүргізіле бастады. Жер сілкіністерінің сенімді алдын ала белгілерін айқындау және оларды қолдану негізінде жер сілкіністерінің уақыты мен орнын орта және қысқа мерзімді болжау мәселелері бүгінгі күнге дейін өзекті болып отыр. Пайдалы қазбалар кен орындарын іздеудің сынаптық әдісі өткен ғасырдың екінші жартысынан бастап геология саласында қолданылып келеді және жасырын әрі терең көмілген кен нысандарын анықтауда өзінің жоғары тиімділігін көрсетті. Сынап тотығу да, тотықсыздану реакцияларында да аса пассивті болып табылады және «химиялық белсенділік» энергиясы бойынша химиялық элементтердің басым көпшілігінен төмен көрсеткішке

ие. Сынаптың бірегей физика-химиялық қасиеттері, әсіресе оның басқа газдарға қатысты инерттілігі жағдайындағы жоғары көші-қон қабілеті, жұмыс тәжірибесі көрсеткендей, жер сілкіністерін қысқа мерзімді болжау және тектоникалық ақауларды картаға түсіру мақсатында қолдануға мүмкіндік береді. Ұңғымаларда, атмосферада, топырақ ауасында, сондай-ақ сейсмикалық белсенді аймақтардағы жер үсті және жер асты суларында сынап мөлшерін өлшеу оның жер сілкінісі алдындағы және жер сілкінісінің даму кезеңіндегі қалыптан тыс өзгерістерін анықтауға мүмкіндік береді. Модельдік зерттеулердің нәтижелері бойынша сынаптың тау жыныстарынан бөлініп шығуы дайындық кезеңінде және жер сілкінісі барысында әсер ететін механикалық (геодинамикалық) жүктемелермен тікелей байланысты деп болжанады. Сейсмикалық белсенді аймақтардағы қоршаған орта объектілеріндегі сынап құрамын зерттеу бойынша бұрын жүргізілген жұмыстарға жасалған қысқаша шолу бұл әдісті сейсмологиялық мәселелерді шешуде қолданудың болашағы зор екенін көрсетеді. Аталған зерттеулерді жүргізу үшін қоршаған ортаның әртүрлі объектілеріндегі сынаптың ультра төмен концентрацияларын анықтауға мүмкіндік беретін заманауи сынап өлшеу аппаратурасы бар.

Түйін сөздер: сынапты өлшеу, сынап мөлшері, тектоникалық жарықтар, картаға түсіру, топырақ ауасы, жер бетіндегі атмосфера, жер асты сулары, жер сілкінісін болжау, алдын ала белгілер

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ВОЗМОЖНОСТИ РТУТОМЕТРИЧЕСКИХ ИССЛЕДОВАНИЙ ПРИ ОЦЕНКЕ СЕЙСМИЧЕСКОЙ ОПАСНОСТИ И ПРОГНОЗИРОВАНИЯ ЗЕМЛЕТРЯСЕНИЙ

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Аннотация. Начиная с середины 60-х годов прошлого века во многих странах были начаты исследования по поиску предвестников землетрясений. Вопросы определения надежных предвестников землетрясений, а также средне- и краткосрочного прогноза времени и места землетрясений на

основе их применения до настоящего времени остаются актуальной проблемой. РтутOMETрический метод поисков месторождений полезных ископаемых начал применяться в геологической отрасли со второй половины прошлого века и показал эффективность в выявлении скрытых и скрыто-погребенных объектов. Ртуть весьма пассивна как в окислительных, так и в восстановительных реакциях, и по величине энергии «химической активности» уступает место подавляющему большинству химических элементов. Уникальные физико-химические свойства ртути и, в особенности, ее высокая миграционная способность при инертности к другим газам, как показывает практика, могут быть применены для краткосрочного прогноза землетрясений и картирования тектонических разломов. Измерения содержания ртути в воде в скважинах, в атмосфере, в почвенном воздухе, в поверхностных и грунтовых водах в сейсмоактивных зонах свидетельствуют об аномальных изменениях ее концентраций перед землетрясением, а также на стадии развития афтершоков. На основе модельных работ высказано предположение, что выход ртути из горных пород находится в прямой зависимости от механических (геодинамических) нагрузок, которые возникают на стадии подготовки и во время землетрясений. Краткий обзор ранее проведенных исследований содержания ртути в объектах окружающей среды в сейсмоактивных зонах свидетельствует о перспективах использования метода при решении сейсмологических задач. Для проведения этих исследований имеется современная ртутOMETрическая аппаратура, позволяющая определять ультрамалые концентрации ртути в различных объектах окружающей среды.

Ключевые слова: ртутOMETрия, содержание ртути, тектонические разломы, картирование, почвенный воздух, приземная атмосфера, подземные воды, прогноз землетрясений, предвестники

Introduction. The unique physicochemical properties of mercury are commonly used in the search for mercury and mercury-containing mineral deposits (polymetallic, gold-silver, antimony deposits, etc.) (Fursov, 1983:206). It has been discovered that mercury is also an indicator of oil and gas deposits. Due to its high migratory ability, mercury forms anomalous concentrations in the soil, soil air, and near-surface atmospheric air above hidden and buried deposits, which can be easily detected with modern mercury-metering equipment. It is known that the formation of mineral deposits is associated with tectonic faults, which also serve as channels for mercury migration from anomalous source objects (deposits) to the Earth's surface. Furthermore, it has been established that under dynamic impact on the soil environment, the anomalous mercury concentrations in the soil air above mineral deposits increase in proportion to the intensity of the load (Kamberov, 1989:4).

Research Methodology. Starting from the mid-1960s, many countries began research on the search for earthquake precursors. In particular, studies on geochemical precursors began after the phenomenon of changes in the chemical composition of groundwater before and after earthquakes was discovered. Soviet

scientists, based on five years of observations in the water of a balneological well in Tashkent, found a threefold increase in the concentration of radon, mercury, and several other elements, with this elevated level being maintained for six months before the earthquake. After the earthquake, the concentrations of radon and mercury decreased below the initial levels (Abdullaev, 2002:352; Abdullaev, 2010:7). Mercury is easily released from rocks during thermodynamic processes, particularly from the Earth's crust during earthquakes. In Dushanbe, for example, approximately one day before the main earthquake on September 29, 1981, the concentration of gaseous mercury increased by 400% at a distance of 20 km from the epicenter (Varshal, 1984:14). The authors of the studies (Cicerone, 2009:25) confirm that mercury emanations are a precursor to earthquakes. Research on mercury emissions showed its anomalous concentrations in seismogenic faults. Elevated mercury concentrations associated with earthquakes were also found in groundwater, meaning that during earthquakes, mercury is not only released as a gas but also detected in underground waters (Koval, 2003:4 a). These findings provided the basis for the search for hydrogeochemical precursors of earthquakes and for identifying the most effective precursors among them. The results of these studies demonstrated the potential for studying mercury content as an earthquake precursor.

In the theoretical aspect, according to the authors of the study (Schwartzman, 1988:5), it is considered correct to give preference to the study of those chemical elements and their compounds that meet the following conditions as possible precursors to earthquakes: 1) they have high physical mobility; 2) they possess low chemical reactivity. Based on the analysis of the physical properties of chemical elements, the authors conclude that mercury, compared to other chemical elements, has a relatively high physical mobility, which determines its potentially high ability to migrate over long distances in a relatively short period of time. This satisfies the first condition of the theoretical aspect regarding the search for earthquake precursors. Mercury is highly passive in both oxidation and reduction reactions and, in terms of its "chemical activity" energy, is surpassed by the overwhelming majority of chemical elements, thus fulfilling the second condition. Therefore, the unique physicochemical properties of mercury make it an important indicator of the energetic changes occurring in the depths of the Earth's crust, related to the development of an earthquake's epicenter.

In the monograph (Abdullaev, 2002:352), the author also considers the emanation of mercury vapors in soil air, hydrotherms, and the near-surface atmosphere to be more promising for detecting deep, activated faults in the theoretical sense, due to its geochemical stability, inertness, and very high volatility. Observations of the degassing process show that its intensity changes quite distinctly during the preparation and occurrence of major earthquakes. Figure 1 presents generalized data on the composition of free gases in the fault zones of the Kemino-Chilik structure, which shows that in modern gas emanations in active faults, the absolute value of CH₄ and heavy hydrocarbons increases by three orders of magnitude compared to background values, while mercury increases by one to two orders of magnitude.

Gas composition	 - background content	 - on active faults	Absolute short exceedance
Hg $n \cdot 10^{-7} \text{ mg/l}$	 0.33	 18	48
CH_4 $n \cdot 10^{-4} \text{ cm}^3/\text{kg}$	 0.8	 2838	3500
Heavy hydrocarbons $n \cdot 10^{-4} \text{ cm}^3/\text{kg}$	 0.8	 2820	3500
CO_2 vol. %	 20	 10	5

Figure 1. Composition of free gases in fault zones of the Kemino-Chilik structure

During the implementation of the “Intercosmos - 1988” program in Central Asia, a team of researchers studied the gas-chemical activity of major faults. A vast fragmentation zone, 10 km wide, was identified along the Talas-Fergana fault profile. The central part of this zone is essentially “sealed.” Good permeability is noted only along its southern and northern borders. Gas emanations, including mercury, He, and Rn, occur along these channels of the transregional fault, with intensities an order of magnitude or more higher than in the compacted central part of the fault and outside its boundaries. The mercury flow is estimated at a level of 10^{-8} mg/l (Figures 2 and 3).

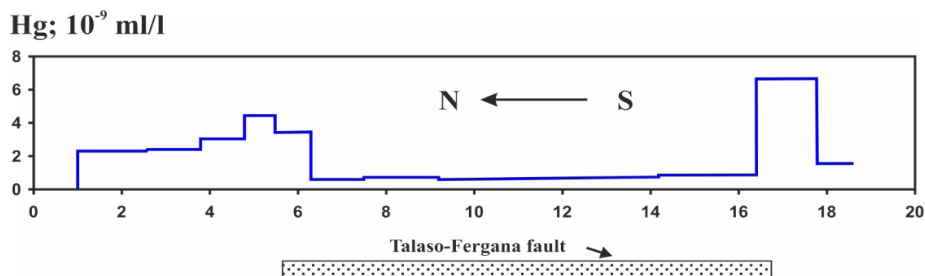


Figure 2. Mercury vapor flows above the Talas-Fergana fault (profile, Intercosmos, 1988)

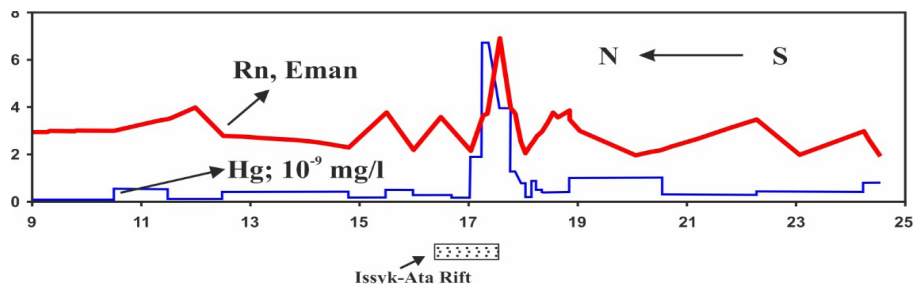


Figure 3. Mercury vapor flows and radon emanations above the Issyk-Ata Fault (profile, Intercosmos, 1988)

Modeled observations of mercury vapor concentrations in soil air at an observation shaft near the city of Frunze showed anomalous concentrations just before the earthquake that occurred on August 23, 1985.

According to (Sultanhodzhaev, 1982:34), promising results were obtained when measuring mercury content in well water, indicating the potential of using mercury as a precursor. Chinese scientists (Yangfen, 1989:195) conducted model studies aimed at investigating the possibility of increasing mercury flow by injecting liquid under high pressure (fracking) into an aquifer. The results of three experiments revealed a 50%, 5-fold, and 60-fold increase in mercury content compared to background levels.

The article (Rasskazov, 2022:3) discusses the results of research on long-term and short-term variations in mercury (Hg) concentrations in groundwater from 2017 to 2022 on the western shore of Lake Baikal. The variations studied from 2019 to 2022 were associated with the seismic reactivation of active faults in Baikal and Khubsugul during the 2020–2021 period. The authors concluded that the increase in mercury concentrations in groundwater was linked to the expansion of the Earth's crust, with the highest Hg enrichment caused by aftershocks. Mercury flow depends on the nature of fault activity, and its elevated concentrations in sedimentary layers may indicate the release of various forms of mercury from seismically active faults in the past. The seismic process is reflected in the sequential change in the ratio of mercury concentration and the redox potential of groundwater (Chebykin, 2022:12). The authors present data from hydrogeochemical monitoring conducted between 2016 and 2022 at the Kultuk test site, where mercury concentrations in water at different monitoring stations vary by more than an order of magnitude. The mercury content in groundwater at Station 8 (Chertova Gora) is the most indicative for seismological forecasting purposes. From 2017 to the first half of 2019, long-term (yearly) variations in mercury were observed at the station. With the onset of Baikal-Khubsugul seismic activity, the variations shifted to short-term (monthly and weekly) fluctuations, accompanied by an increase in mercury concentration in groundwater, similar to the 2017–2019 interval. The Baikal-Khubsugul activation forms a separate interval of long-term increases and decreases in mercury concentration.

From 10 September 2016 to 9 May 2018, a gradual increase in mercury concentration was observed, rising from values below the detection limit ($<0.009 \mu\text{g}/\text{dm}^3$) to $0.05 \mu\text{g}/\text{dm}^3$. Between 30 May and 28 September 2018, a decrease in mercury concentration was observed, falling below the detection limit. From 22 December 2018 to 20 January 2019, the mercury concentration reached its maximum and then gradually decreased to values below the detection limit by 20 June. The period of low mercury concentration continued until 21 December 2019, began to rise again on 22 January 2020, and then reached episodic peaks typical of the Baikal-Khubsugul activation. According to the authors of the study (Chebykin, 2022:12), the bay-like drop in mercury concentration, lasting for 6 months, can be considered as a pre-seismic indicator.

At the scientific stationary base “Enkhaluk” of the Institute of Petroleum and Gas Geology and Geophysics, Siberian Branch of the Russian Academy of Sciences, the chemical composition and physicochemical parameters of hot spring water were measured, and samples were taken for mercury concentration analysis. Annual observations revealed changes in mercury concentrations that accompany seismic events with magnitudes greater than 4 in the area of the study site (Saeva, 2024:6).

In the mid-1990s, prior to the South Baikal earthquake of 1999, five years of monitoring were conducted on mercury content in the surface waters of Lake Baikal at the source of the Angara River, and an increase in mercury concentration was recorded before the strong South Baikal earthquake (Koval, 2003:5).

Along with studies of mercury in groundwater and wells, work was also carried out to examine mercury content in well gases (Li Xuanhu, 1992:223), based on which it was concluded that mercury emanations are the best short-term precursor to earthquakes. An increased concentration of mercury was recorded after the earthquake in the Tashkent region in April 1966. The authors (Fursoy, 1983:206) suggested that mercury could serve as a precursor to earthquakes. The results of modeling the processes of earthquake precursor formation under mechanical stress (Varshall, 1985:463) showed that the increased release of mercury from rock indicates the onset of the initial phase of the destruction process. Similar studies were conducted on samples of coal, sylvinit, and carnallite (Perezhilov, 1995:14). It was found that under loads of approximately 2/3 of the destructive threshold, mercury vapor emissions increased by 3 to 8 times. In Tajikistan, studies were conducted on the registration of mercury precursors in natural conditions within a seismically active zone. In addition to determining mercury content in well waters over more than two weeks, the flow of mercury vapor from the soil environment was recorded. It was shown that changes in mercury content in water exhibit significantly greater inertia compared to changes in the flow of mercury vapor during daily and hourly sampling. Research conducted on the outskirts of Dushanbe established the high sensitivity of mercury vapor flow to seismic fluctuations (Stakheev, 1975:7) and evaluated the correlation between mercury vapor flow registration results and predictive patterns. From 1981 to 1985, regime observations of changes in gaseous mercury concentration were conducted on the Issyk-Ata fault zone in soil and atmospheric air samples (Mozoleva, 1989:9).

It has been established that, in addition to the general trend of changes in mercury vapor concentrations, there are also spikes in their levels, corresponding to the Local and Gazli earthquakes. In the study (Ryzhova, 2003:7), direct measurements of mercury (Hg) content in natural gases in real-time at two gas fields, Oposhnya and Mirnenskoye, revealed short-term variability in Hg concentration across all the studied gas wells. Their characteristics include the periodicity of their cycles and a good correlation with the phases of the Earth's own oscillations.

Conclusion. Thus, a brief overview of previously conducted studies on mercury content in various environments and across many seismically active regions, aimed

at exploring and assessing the possibility of using the element as an earthquake precursor, allows for the following conclusions:

1. The unique physicochemical properties of mercury justify its consideration not only as a method for searching mineral deposits but also as one of the most important informants about hydrogeochemical changes occurring in the Earth's crust, related to the development of earthquake foci.

2. The high physical mobility and low inertness of mercury to its environment suggest its potential application as a predictive parameter for medium- and short-term earthquake forecasting and the mapping of seismically active faults.

3. For reliable identification of fault activity, mercury measurements, particularly its measurement in soil air, can be effectively used in modified mercury-metric techniques.

References

Abdullaev A.U. (2002) *Fljuidnyj rezhim zemnoj kory kak otrazhenie sovremennyh geodinamicheskikh processov* [Fluid Regime of the Earth's Crust as a Reflection of Modern Geodynamic Processes]. – Almaty, Evero. – P. 352. (in Russian).

Abdullaev A.U. (2010) *Geohimicheskie indikatory mezhgeosfernyh vzaimodejstvij «zemnaja kora-atmosfera» v sejsmoaktivnyh oblastjakh. Prognoz zemletrjasenij i ocenka sejsmicheskoy opasnosti i sejsmicheskogo riska Central'noj Azii* [Geochemical Indicators of Inter-Sphere Interactions "Earth's Crust - Atmosphere" in Seismically Active Areas. Earthquake Forecast and Assessment of Seismic Hazard and Risk in Central Asia]. – Almaty. – P. 130-136. (in Russian).

Chebykin E.P., Ilyasova A.M., Snopkov S.I., Rasskazov S.V. (2022) *Signaly rtuti podzemnyh vod Kultuskogo poligona vo vremja podgotovki i realizacii Bajkalo-Hubsugul'skoj sejsmicheskoy aktivizacii 2020-2021 gg.* [Mercury Signals in Groundwater of the Kultuk Polygon During the Preparation and Realization of the Baikal-Khubsugul Seismic Activation of 2020-2021]. DOI: 10.26516/2541-9641.2022.1.7 (in Russian).

Cicerone R.D., Ebel J.E., Britton J. (2009) *A Systematic Compilation of Earthquake Precursors. Tectonophysics*, 476: 371-396 (in Eng.).

Fursov V.Z. (1983) *Gazortutnyj metod poiskov mestorozhdenij poleznyh iskopaemyh* [The Mercury Gas Method for the Search of Mineral Deposits]. – Moscow, Nauka. – P. 206. (in Russian).

Kamberov I.M. (1989) *Rezul'taty opytnyh gazortutnyh issledovanij po vozbuzhdennomu geohimicheskomu polju* [Results of Experimental Mercury Gas Studies in the Excited Geochemical Field]. *Izv. AN KazSSR, Geology Series.* – P. 84-87. (in Russian).

Koval P.V., Udodov Yu.N., Andrulaitis L.D. et al. (2003). *Mercury in the Source of the Angara River: Five-Year Concentration Trend and Possible Reasons for Its Variations. Doklady Earth Sciences*, 389(2). – P. 282-285. (in Eng.).

Koval P.V.; Udodov Yu.N.; Andrulaitis L.D.; Sankov V.A.; Gapon A.E. (2003) *Mercury in the Source of the Angara River: A Five-Year Concentration Trend and Possible Reasons for Its Variations. Doklady RAN*, 2. – P. 235-238. (in Eng.).

Li Xuanhu. J. (1992) *Earthquake Prediction Res.* 1: 223. (in Eng.).

Mozoleva E.L. (1989) *Analiz variacij gazortutnogo polja nad sejsmicheski aktivnym rajonom* [Analysis of Variations in the Mercury Gas Field Over a Seismically Active Area]. *Seismicity of the Tien Shan, F. – Ilm:* 265-274. (in Russian).

Perezhilov A.E., Stakheev Yu.I., Ibraev T.A. (1995) *Geohimicheskie predvestniki zemletrjasenij* [Geochemical precursors of earthquakes]. *Mining Journal*, 2. – P. 14. (in Russian).

Rasskazov S.V., Ilyasova A.M., Snopkov S.V., Chuvashova I.S., Chebykin E.P. (2022) *Mercury Hazard of Earthquakes in the Baikal Seismic Zone. Limnology and Freshwater Biology* 3: 1332-1334. <http://limnol.fwbiol.com/index.php/LFWB/article/view/902> (in Eng.).

Ryzhova V., Mashyanova N., Ozerova N., Pogareva S. (2003) Regular Variations of Mercury Concentration in Natural Gas. *The Science of the Total Environment*, 304: 145–152. (in Eng.).

Saeva O.P., Dyadkov P.G., Volynkin S.S. (2024) Rtut' v podzemnyh vodah Bajkala – gidrogeohimicheskij predvestnik zemletrjasenij? [Mercury in Groundwater of Baikal – A Hydrogeochemical Earthquake Precursor?] *Materials of the International Scientific Conference “Subsoil Use. Mining. Directions and Technologies for Searching, Exploration, and Development of Mineral Deposits. Economics. Geoecology.”* Novosibirsk, SGUGiT Publishing, 2. – P. 83-89. (in Russian).

Schwartzman Yu.G., Kayev Yu.A., Tsevelev M.A., Mozoleva E.L. (1988) Teoreticheskie predposylki ispol'zovanija gazortutnyh anomalij kak vozmozhnogo predvestnika zemletrjasenij [Theoretical Foundations for the Use of Mercury Gas Anomalies as Possible Earthquake Precursors]. *Earthquake Forecast, Dushanbe-Frunze, Donish*, 9. – P. 154-159. (in Russian).

Stakheev Yu., Gerasimovsky V.I., Stakheeva S.A. (1975) *Geochem. Intern.*, 13: 1668. (in Eng.).

Sultanhodzhaev A.N., Abdullaev A.A., Khasanova L.D. et al. (1982) Nekotorye rezul'taty rezhimnyh nabljudenij za variacijami rtuti v podzemnyh vodah Tashkentskogo geodinamicheskogo poligona. [Some results of routine observations of mercury variations in groundwater of the Tashkent geodynamic test site]. *Uzgeol. Journal*, 2: 34. (in Russian).

Varshal G.M., Sobolev G.A., Barsukov V.L. et al. (1984) Separation of Volatile Components from Rocks under Mechanical Loading as the Source of Hydrogeochemical Anomalies Preceding Earthquakes. *Pure and Applied Geophysics* 122. – P. 463-477. (in Eng.).

Yangfen I., Zonghua W., Chunsheng S. et al. (1989) *J. Geochem. Explor.*, 33: 195. (in Eng.).

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