SCIENCE OF EARTH

UDC 551.736.3:553.07 (282.256.861) DOI 10.18522/0321-3005-2016-2-78-85

ON THE ROLE OF VOLCANIC MATERIAL IN THE FORMATION OF ATKAN SUITE OF AYAN-YURYAKH ANTICLINORIUM OF YAN-KOLYMA FOLDED AREA

© 2016 A.A. Astakhova, A.E. Khardikov, I.A. Kholodnaya

Astakhova Anna Aleksandrovna – Competitor, Mineralogy and Petrography Department, Southern Federal University, Zorge St., 40, Rostov-on-Don, 344090, Russia.
Khardikov Aleksandr Eduardovich – Doctor of Geologic and Mineralogical Science, Professor, Mineralogy and Petrography Department, Southern Federal University, Zorge St., 40, Rostov-on-Don, 344090, Russia, e-mail: khardikov@sfedu.ru

Kholodnaya Irina Alekseevna – Candidate of Geologic and Mineralogical Science, Senior Geologist, AO «Magadangeologia» of the State Corporation «Rosgeologia», Dzerzhinskii St., 6, Magadan, 685000, Russia.

Origin of volcanics in Atkan suit of permian volcano-clastic deposits of the Ayan-Yurakh Anticlinorium are observed in the paper. Atkan suit was formed, at the same time, by volcanics and deltaic material during the volcanism. Volcanic island, growed by volcanic explosion intermediate-alkali composition, groups in chain coincide with Ayan-Yurakh Anticlinorium axes and tend to the deep fault.

Keywords: *Ayan-Yurakh Anticlinorium, Atkan suit, ore gold, volcano-clastic rocks, underwater volcanism.*

References

1. Grigorov S.A., Vorozhbenko V.D., Kushnarev P.I., Markevich V.Yu., Tokarev V.N., Chichev V.I., Yagubov N.P. Natalkinskoe zolotorudnoe mestorozhdenie – stroenie i osnovnye poiskovye priznaki [Natalka gold deposit - structure and basic search features]. *Otechestvennaya geologiya*, 2007, no 3, pp. 43-50.

2. Byakov A.S. [About Permian paleogeography and geodynamics of the North-East Asia (sedimentological and biogeographic data)]. *Materialy Vseros. soveshchaniya, posvyashch. 90-letiyu akad. N.A. Shilo* [Proc. meeting, devoted. 90th anniversary of acad. N.A. Shilo]. Vol. 1. Magadan, 2003, pp. 131-134.

3. Ganelin V.G. [Taimyr-Kolyma subdomain]. *Osnovnye cherty stratigrafii permskoi sistemy SSSR* [The main features of the stratigraphy of the Permian system of the USSR]. Work of VSEGEI. New Series. Leningrad, 1984, vol. 286, pp. 111-142.

4. Umitbaev R.B., Vel'dyaksov F.F. [The tectonic and metallogenic zoning of Okhotsk median massif and its surroundings*]*. *Voprosy geologii sredinnykh massivov Severo-Vostoka SSSR* [Geology median massifs of the North-East of the USSR]. Magadan, 1977, pp. 79-98.

5. Chumakov N.M. Sledy pozdnepermskogo oledeneniya na reke Kolyme: otzvuk gondvanskikh oledenenii na Severo-Vostoke Azii [Traces of Late Permian glaciation on the River Kolyma: the echo of Gondwana glaciations in North-East Asia]. *Stratigrafiya. Geol. korrelyatsiya*, 1994, vol. 2, no 5, pp. 130-150.

6. Epshtein O.G. Verkhnepaleozoiskie ledovo-morskie otlozheniya basseina istokov r. Kolymy [The Upper ice-sea deposits origins of River Kolyma Basin]. *Litologiya i poleznye iskopaemye*, 1972, no 3, pp. 112-127.

7. Byakov A.S. Biostratigrafiya permskikh otlozhenii Severnogo Priokhot'ya (Severo-Vostok Azii) [Biostratigraphy of Permian deposits of North Priokhot'e (Northeast Asia)]. *Stratigrafiya. Geol. korrelyatsiya*, 2007, vol. 15, no 2, pp. 47-71.

8. Byakov A.S., Vedernikov I.L. *Stratigrafiya permskikh otlozhenii severo-vostochnogo obramleniya Okhotskogo massiva, tsentral'noi i yugo-vostochnoi chastei Ayan-Yuryakhskogo antiklinoriya* [Stratigraphy of Permian north-eastern framing of Okhotsk massif, central and south-eastern parts of the Ayan-Yuryakh Anticlinorium]. Preprint. Magadan, 1990, 69 p.

9. Maleev E.F. *Vulkanity* [Volcanics]. Moscow, 1980, 240 p.

10. Khardikov A.E., Kholodnaya I.A. Litologo-fatsial'nye usloviya zolotonosnosti verkhnepermskikh otlozhenii Ayan-Yuryakhskogo antiklinoriya Yano-Kolymskoi skladchatoi oblasti [Lithofacies conditions of

gold-bearing deposits of the Upper-Ayan Yuryakh Anticlinorium of Yano-Kolyma folded area]. *Stratigrafiya i sedimentologiya neftegazonosnykh basseinov*, 2009, no 1, pp. 87-97.

11. Khardikov A.E., Parada S.G., Kholodnaya I.A. Litologo-fatsial'nye usloviya zolotonosnosti verkhnepermskikh otlozhenii Ayan-Yuryakhskogo antiklinoriya Yano-Kolymskoi skladchatoi oblasti [Lithofacies conditions of gold-bearing deposits of the Upper-Ayan Yuryakh anticlinorium of Yano-Kolyma folded area]. *Rudy i metally*, 2009, no 3, pp. 22-28.

12. Goncharov V.I., Voroshin S.V., Sidorov V.A. *Natalkinskoe zolotorudnoe mestorozhdenie* [Natalka gold deposit]. Magadan, 2002, 250 p.

13. Belitskii I.A., Drobot I.V., Valueva G.P., Batiashvili T.V., Vasilenko V.B. *Opyt ekspressnogo opredeleniya tseolitov v gornykh porodakh s ispol'zovaniem portativnykh tseolitnykh laboratorii PTsL-1 i PTsL-2* [Experience the rapid determination of zeolites in rocks with the use of portable laboratories zeolite CPL-1 and CPL-2]. Method. guide. Novosibirsk, 1979, 80 p.

14. Litvinov V.E., Umitbaev R.B. [Stratigraphy of Paleozoic sediments of the Okhotsk massif and the southern part of the Yana-Kolyma geosynclinal system]. *Dokembrii i paleozoi Severo-Vostoka SSSR* [Precambrian and Paleozoic North-East of the USSR]. Magadan, 1974, pp. 142-146.

15. Chikov B.M. *Tektonika Okhotskogo sredinnogo massiva* [Tectonics of the Okhotsk median massif]. Moscow, 1970, 151 p.

16. Byakov A.S., Vedernikov I.L., Akinin V.V. Permskie diamiktity Severo-Vostoka Azii i ikh veroyatnoe proiskhozhdenie [Perm diamiktity of North-east Asia and their probable origin]. *Vestn. Sev.-Vostochn. nauch. tsentra DVO RAN*, 2010, no 1, pp. 14-24.

17. Surchilov V.A. [About Permian magmatism and tectonic nature of Ayan-Yuryakh anticlinorium]. *Nauka Severo-Vostoka Rossii – nachalo veka* [Science North-East of Russia - the beginning of the century]. Magadan, 2005, pp. 127-132.

UDC 528.8, 520.88 DOI 10.18522/0321-3005-2016-2-86-90

PARTICULAR QUALITIES OF THE SOLUTION OF THE RADIAL EQUATION FOR THE STEEP TRAJECTORIES IN THE IONOSPHERE

© 2016 G.A. Zhbankov

Zhbankov Gennadii Anatolievich − Candidate of Physical and Mathematical Science, Senior Researcher, Research Institute of Physics of the Southern Federal University, Stachki St., 194, Rostov-on-Don, 344090, Russia, e-mail: zhbankov@ip.sfedu.ru

The method of geometrical optics is the best approximation of the wave equation in the case of the ionosphere. Amplitude-trajectory calculations within it more consistently and effectively implemented in the way of solving the extended system of characteristic equations (method of characteristics). However, this method has difficulty in calculating an anisotropic medium steep rays. In this paper, we propose a solution to this problem through transfer component of the wave vector in the vicinity of the point of reflection.

Keywords: *amplitude-trajectory calculations, method of characteristics, anisotropic medium, wave vector, system of differential equations, model of the ionosphere, Poverleyn design.*

References

1. Gershman B.N., Erukhimov L.M., Yashin Yu.Ya. *Volnovye yavleniya v ionosfere i kosmicheskoi plazme* [Wave phenomena in the ionosphere and space plasma]. Moscow, 1984, 392 p.

2. Landau L.D., Lifshits E.M. *Mekhanika* [Mechanics]. Moscow, 1988, 216 p.

3. Kravtsov Yu.A., Orlov Yu.I. *Geometricheskaya optika neodnorodnykh sred* [Geometrical optics of inhomogeneous media]. Moscow, 1980, 304 p.

4. *CCIR. Supplement to report 252-2*. Genova, 1982, 38 p.

5. Kiyanovskii M.P., Zyryanova L.A. Metod refraktsionnogo integrala i ego primenenie k raschetu radiotrass [Refractive integral method and its application to the calculation of transmission paths]. *Tekhnika sredstv svyazi. Seriya SS*. Moscow, 1987, no 5, pp. 4-15.

6. Lukin D.S., Spiridonov Yu.G. [Application of the method of characteristics for solving problems on the computer of electromagnetic wave propagation in inhomogeneous anisotropic media]. *Luchevoe priblizhenie i voprosy rasprostraneniya radiovoln* [The ray approximation and propagation issues]. Moscow, 1971, pp. 265-279.

7. Nosikov I.A., Bessarab P.F., Klimenko M.V., Klimenko V.V. Ispol'zovanie metoda poperechnykh smeshchenii dlya rascheta radiotrass v model'noi ionosfere [The use of transverse displacements to calculate the transmission paths in the model the ionosphere].

Physics of Auroral Phenomena. Proc. XXXVIII Annual Seminar. Apatity, 2015, pp. 142-145.

8. Devis K. *Radiovolny v ionosphere* [The radio waves in the ionosphere]. Moscow, 1973, 503 p.

9. Ginzburg V.L. *Rasprostranenie elektromagnitnykh voln v plazme* [The propagation of electromagnetic waves in plasma]. Moscow, 1967. 684 s.

10. Vertogradov G.G. *Kompleksnye issledovaniya ionosfernogo rasprostraneniya dekametrovykh radiovoln na trassakh raznoi protyazhennosti* : dis. … d-ra fiz.-mat. nauk [Integrated studies of the ionospheric propagation of decameter radio waves on the routes of varying length]. Rostov-on-Don, 2007.

11. Korn G., Korn T. *Spravochnik po matematike dlya nauchnykh rabotnikov i inzhenerov* [Handbook of mathematics for scientists and engineers]. Moscow, 1973, 832 p.

UDC 504.55.054:622 +504.43 (470.61) DOI 10.18522/0321-3005-2016-2-91-99

COMPARATIVE EVALUATION OF THE QUALITY OF EASTERN DONBASS SURFACE AND GROUNDWATER BY THE HYDROCHEMICAL INDICATORS

© 2016 V.E. Zakrutkin, E.V. Gibkov, G.Yu. Sklyarenko, O.S. Reshetnyak

Zakrutkin Vladimir Evgen'yevich – Doctor of Geologic and Mineralogical Science, Professor, Head of Department of Geoecology and Applied Geochemistry, Institute of Earth Sciences of the Southern Federal University, Zorge St., 40, Rostov-on-Don, 344090, Russia, e-mail: vezak@list.ru

Gibkov Evgenii Viktorovich – Senior Lecturer, Department of Geoecology and Applied Geochemistry, Institute of Earth Sciences of the Southern Federal University, Zorge St., 40, Rostov-on-Don, 344090, Russia, e-mail: irvict@mail.ru
Sklyarenko Grigorii Yurievich – Candidate of Geologic and Mineralogical Science, Associate Professor, Department of Geoecology and Applied Geochemistry, Institute of Earth Sciences of the Southern Federal University, Zorge St., 40, Rostov-on-Don, 344090, Russia, e-mail: geoeco@sfedu.ru

Reshetnyak Olga Sergeevna − Candidate of Geologic and Mineralogical Science, Associate Professor, Department of Geoecology and Applied Geochemistry, Institute of Earth Sciences of the Southern Federal University, Zorge St., 40, Rostov-on-Don, 344090, Russia, e-mail: olgare1@rambler.ru

The results of comparative evaluation of chemical composition and surface and groundwater quality (pollution level) of the Eastern Donbas by hydrochemical parameters are presents in the article. The same set of typomorphic polluting components (Na+K, Ca, Mg, SO_4, Fe, Al, Be, Li, Mn, Cu) was identified. The investigated surface and groundwater have the same level of contamination by total factor of pollution. The close relationship between the surface and ground hydrosphere within the Eastern Donbas and the essential role of technogenic mine water in the formation of their quality was shown.

Keywords: *surface water, groundwater, Eastern Donbas, chemical composition of water, pollution level, technogenic mine water.*

References

1. Vernadskii V.I. *Istoriya prirodnykh vod* [History of natural waters]. Moscow, 2003, 751 p.

2. Nikanorov A.M. *Gidrokhimiya* [Hydrochemistry]. Textbook. Rostov-on-Don, 2008, 461 p.

3. Zakrutkin V.E., Ivanik V.M., Gibkov E.V, Sklyarov V.V. Otsenka vliyaniya likvidiruemykh shakht Vostochnogo Donbassa na gidrokhimicheskii sostav malykh rek basseina Severskogo Dontsa [Assessing the impact of liquidating the Eastern Donbass mines on the hydrochemical composition of the low river basin of the Seversky Donets]. *Izv. vuzov. Sev.-Kavk. region. Estestv. nauki*, 2010, no 3, pp. 84-87.

4. Zakrutkin V.E., Ivanik V.M., Gibkov E.V. [State water pollution of the rivers of the Rostov region in the areas of technogenic influence of liquidated mines of East Donbass (Tuzlov basin)]. *Sovremennye fundamental'nye problemy gidrokhimii i monitoringa kachestva poverkhnostnykh vod Rossii* [Modern fundamental problems of hydrochemistry and monitoring the quality of surface waters of Russia]. Materials of scient.-pract. conf. with int. participation. Ch. 1. Rostov-on-Don, 2009, pp. 88-91.

5. Belousova A.P., Gavich I.K., Lisenkov A.B., Popov E.V. *Ekologicheskaya gidrogeologiya* [Environmental hydrogeology]. Moscow, 2006, 397 p.

6. *Pit'evaya voda. Gigienicheskie trebovaniya k kachestvu vody tsentralizovannykh sistem pit'evogo vodosnabzheniya. Kontrol' kachestva* [Drinking water. Hygienic requirements for water quality of centralized drinking water supply systems. Quality control]. SanPiN 2.1.4.1074-01. Moscow, 2002, 62 p.

7. Zakrutkin V. E., Ivanik V.M., Gibkov E.V. Ekologo-geograficheskii analiz riskov restrukturizatsii ugol'noi promyshlennosti v Vostochnom Donbasse [Ecological and geographical analysis of the risk of restructuring the coal industry in the Eastern Donbass]. *Izv. RAN. Ser. geograficheskaya*, 2010, no 5, pp. 94-102.

8. Zakrutkin V.E., Sklyarenko G.Yu., Gibkov E.V. Osobennosti khimicheskogo sostava i stepen' zagryaznennosti podzemnykh vod uglepromyshlennykh raionov Vostochnogo Donbassa [Features of the chemical composition and the degree of contamination of groundwater coal-mining areas of the Eastern Donbass]. *Izv. vuzov. Sev.-Kavk. region. Estestv. nauki*, 2014, no 4, pp. 73-77.

9. Nikanorov A.M., Stradomskaya A.G., Ivanik V.M. *Lokal'nyi monitoring zagryazneniya vodnykh ob"ektov v raionakh vysokikh tekhnogennykh vozdeistvii toplivno-energeticheskogo kompleksa* [Local monitoring water pollution in areas of high technological impacts of fuel and energy complex]. Saint Petersburg, 2002, 156 p.

10. Mokhov A.V., Zhurbitskii B.I., Karasev G.K., Dymna A.I. [Influence of coal complex on geoecological situation]. *Problemy i perspektivy kompleksnogo osvoeniya mineral'nykh resursov Vostochnogo Donbassa* [Problems and prospects of integrated development of mineral resources of the Eastern Donbass]. Rostov-on-Don, 2005, pp. 129-138.

11. *Ekologicheskii monitoring likvidatsii neperspektivnykh shakht Vostochnogo Donbassa* [Environmental monitoring liquidation of unpromising mines of East Donbass]. Ed. V.M. Eremeev. Shakhty, 2001, 182 p.

UDC 911.2: 556.51/54 DOI 10.18522/0321-3005-2016-2-100-104

THE GEOMORPHOLOGICAL FEATURES OF TEBERDA RIVER VALLEY BOTTOM (NORTHERN CAUCASUS)

© 2016 P.A. Kipkeeva, Yu.Ya. Potapenko

Kipkeeva Palistan Aubekirovna − Candidate of Geographical Science, Associate Professor, Department of Physical and Economic Geography, Natural and Geographical Faculty, Aliev Karachay-Cherkess State University, Lenin St., 29, Karachaevsk, KCR, 369202, Russia, e-mail: kipkeeva62@mail.ru

Potapenko Yurii Yakovlevich − Doctor of Geologic and Mineralogical Science, Professor, Department of Physical and Economic Geography, Natural and Geographical Faculty, Aliev Karachay-Cherkess State University, Lenin St., 29, Karachaevsk, KCR, 369202, Russia, e-mail: nupotap@yandex.ru

Morphometric researches of the basin of the river Teberda are conducted. Linear and vulgar elements of a terrestrial surface with application of GIS-technologies are systematized. From linear elements the main attention is paid to thalwegs of valleys for which orders are determined by R. Horton's method. The morphology and density of an erosive network are established. The vulgar elements of the bottom of the valley created by glacial and fluvial processes are recorded. The bottom of the valley includes three segments: actually trough with glacial flyuvial, the trough transformed (terraced) and alluvial erosive and accumulative. Stadial terraces are interfaced to final moraines of the receded valley glaciers.

Keywords: *river basin, morphometry of an erosive network, trough valleys, bottoms of valleys, terraces.*

References

1. Isachenko A.G. *Landshaftovedenie i fiziko-geograficheskoe raionirovanie* [Maintenance of landscapes and physical-geographical regionalization]. Moscow, 1991, 366 p.

2. Shal'nev V.A. Lagun S.G., Nefedova M.V., Nikolaev D.A. [Teberda Reserve Landscapes]. *Tr. Teberdinskogo gosudarstvennogo prirodnogo biosfernogo zapovednika* [Proceedings of the Teberda State Nature Biosphere Reserve]. Vol. 48. Kislovodsk, 2009, 176 p.

3. Kazanskii B.A. [Quantitative characterization of the structure of river systems]. *Tr. DVNIGMI* [Proc. FERHRI]. Leningrad, 1976, vol. 54, pp. 62-68.

4. Lastochkin A.N. Morfometricheskie issledovaniya v geomorfologii. 1. Klassifikatsiya morfometricheskikh postroenii i kharakteristik [The morphometric studies in geomorphology. 1. Classification of constructions and morphometric characteristics]. V*estn. Leningr. un-ta. Ser. 7 : Geologiya, geografiya*, 1988, vol. 3, no 11, pp. 37-50.

5. Shchukin I.S. *Obshchaya geomorfologiya* [General geomorphology]. Moscow, 1960, vol. 1, 615 p.; 1964, vol. 2, 564 p.; 1974, vol. 3, 382 p.

6. Rais R. Dzh. *Osnovy geomorfologii* [Fundamentals of geomorphology]. Transl. from English. Moscow, 1980, 574 p.

7. Lur'e P.M., Panov V.D., Tkachenko Yu.Yu. *Reka Kuban'. Gidrografiya i rezhim stoka* [Kuban River. Hydrography and flow regime]. Rostov-on-Don, 2005, 498 p.

8. Potapenko Yu.Ya., Kipkeeva P.A., Kurumbaev I.R. [The results of geo-environmental survey River Teberda valley]. *Landshaftno-rekreatsionnyi potentsial Karachaevo-Cherkesii* [Landscape-recreational potential of Karachay-Cherkessia]. Proceedings XII scient.-pract. conf. November 27, 2015. Karachaevsk, 2015, pp. 38-44.

9. Kozhevnikov A.V. [Upper pliocene and quaternary sediments of the Kuban valley]. *Geologiya Tsentral'nogo i Zapadnogo Kavkaza* [Geology of the Central and Western Caucasus]. Caucasian expedition VAGT works and the Moscow State University for the 1959 - 1960 years. Vol. 3. Moscow, 1962, pp. 162-187.

10. Tushinskii G.K. [Modern and ancient Teberda District glaciation]. *Pobezhdennye vershiny (ezhegodnik sovetskogo al'pinizma)* [Defeated tops (Yearbook of the Soviet mountaineering)]. Moscow, 1949, pp. 263-297.