AN EXPERIENCE OF CREATING PREDICTIVE-METALLOGENIC MAPS BASED ON OPEN GEOLOGICAL AND GEOPHYSICAL DATA IN GIS ENVIRONMENT

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The issues of using GIS tools for the preparation and design of predictive-metallogenic maps in accordance with the current normative documents and the experience of domestic geological cartography are considered. Predictive and mineralogical maps of scale 1 : 1 000 000 and 1 : 200 000 for the Baikal-Amur group of metallogenic provinces were made in the ArcGIS environment. Open and stock geological and geophysical data were used as the main sources of information – unified digital models of the State Geological Maps at a scale of 1 : 1 000 000 (third generation) and 1 : 200 000 (second generation), digital maps of the anomalous magnetic field and the field of gravity in the Bouguer reduction at a scale of 1 : 2 500 000, objects of geological and geophysical study and others. The features of these data use in the formation of mathematical, topographic and thematic basis of maps are noted. Recommendations on application of ArcGIS tools for cartographic works are given, examples of prepared predictive-metallogenic maps sheets are presented.

Keywords: Baikal-Amur group of metallogenic provinces, geodata, GIS project, State Geological maps, metallogenic mapping

REFERENCES

1. Guidelines for the preparation of sheets of the State Geological Map of the Russian Federation at a scale of 1 : 1 000 000 (third generation). Version 1.4. (2019). Saint Petersburg: Cartographic factory VSEGEI, 169 p. [in Russian].

2. Unified requirements for the composition, structure and presentation formats of digital materials of sheets of State Geological Maps at scales of 1 : 1 000 000 and 1 : 200 000. Version 1.6. (2019). Saint Petersburg: Cartographic factory VSEGEI, 280 p. [in Russian].

3. Examples of design of graphic elements of GK-200/2 (1000/3) sets. Version 1.4. (2019). Saint Petersburg: Cartographic factory VSEGEI, 118 p. [in Russian].

4. Methodological recommendations on the content and design of Gosgeolkarta-200/2 and Gosgeolkarta-1000/3, published digitally. (2014). Saint Petersburg: Cartographic factory VSEGEI, 16 p. [in Russian].

5. Loginov, D. S. (2019) Cartographic support of geophysical research: current state and prospects. *Geodeziya i kartografiya [Geodesy and Cartography]*, *80*(8), 32–44. doi: 10.22389/0016-7126-2019-950-8-32-44 [in Russian].

6. Chitalin, A. F., Agapitov, D. D., Shtengelov, A. R., Usenko, V. V., & Fomichyov, Y. V. (2020). Geological targeting – A tool to increase efficiency of prospecting. *Mineral'nye resursy Rossii. Economika i upravlenie [Mineral Resources of Russia. Economics and Management]*, 3(172), 10–18 [in Russian].

7. Burde, A. I., Strelnikov, S. I., Mezhelovsky, N. V., & et al. (2000). *Tri veka geologicheskoi kartografii Rossii [Three centuries of geological cartography of Russia]*. Moscow–Saint-Petersburg, 439 p. [in Russian].

8. *Obshhie principy regional'nogo metallogenicheskogo analiza i metodika sostavlenija metallogenicheskoj karty dlja skladchatyh oblastej [General principles of regional metallogenic analysis and the methodology of the metallogenic map for folded areas]*. (1957). Moscow: Geosgeolizdat, 157 p. [in Russian].

9. Bilibin, Yu. A. (1955). *Metallogenicheskie provincii i metallogenicheskie jepohi [Metallogenic provinces and metallogenic eras]*. Moscow: Geosgeolizdat, 87 p. [in Russian].

10. Shatalov, E. T., Orlova, A. V., Yablokov, K. V., & et al. (1964). *Osnovnye principy sostavlenija, soderzhanie i uslovnye oboznachenija metallogenicheskih prognoznyh kart rudnyh rajonov [Main principles of drawing up, content and symbols of metallogenic predictive maps of ore districts*. Moscow: Nedra Publ., 197 p. [in Russian].

11. Metallogenic map of the USSR at a scale of 1 : 2 500 000 (1967). V. G. Grusheva (Ed.). Moscow: All-Union Aerogeological Trust Publ., 16 sheets [in Russian].

12. Metallogenic map of the USSR at a scale of 1 : 2 500 000. Short explanatory note (1973). Leningrad: VSEGEI Publ., 32 p. [in Russian].

13. Valeev, R. N., Solontsov, L. F., Averyanov, V. I., & et al. (1974). *Osnovnye principy mineragenicheskogo analiza platformennyh oblastej (k sostavleniju kart prognoza nemetallicheskih poleznyh iskopaemyh Russkoj platformy) [Basic principles of the mineralogical analysis of platform areas (to make forecast maps of non-metallic minerals of the Russian platform)]*. Moscow: OTSNTI VIEMS Publ., 51 p. [in Russian].

14. Gorzhevsky, D. I., Ivankin, P. F., Bindeman, N. N., & et al. (1978). *Metodicheskie rekomendacii po prognozirovaniju jendogennyh rudnyh mestorozhdenij (na primere Mestorozhdenij svinca i cinka) [Methodical Recommendations for Prognostication of Endogenous Ore Deposits (for example, Lead and Zinc Deposits)]*. Moscow: TSNIGRI Publ., 44 p. [in Russian].

15. Aksenov, E. M., Valeev, R. N., & Solontsov, L. F. (1979). *Osnovy mineragenicheskogo analiza platformennyh i skladchatyh oblastej (na primere nerudnyh poleznyh iskopaemyh) [Fundamentals of mineralogical analysis of platform and folded areas (by the example of non-metallic minerals)]*. Moscow: WIEMS Publ., 62 p. [in Russian].

16. Shcheglov, A. D. (1980). *Osnovy metallogenicheskogo analiza [Fundamentals of metallogenic analysis]*. Moscow, Nedra Publ., 431 p. [in Russian].

17. Rundkvist, D. V. (1989). *Atlas «Metallogenija SSSR» [Atlas "Metallogeny of the USSR"]*, 48 p. [in Russian].

18. Bogdanov, Ju. V. (Ed.). (1981). *Metallogenicheskaja karta regiona BAM. Masshtab 1 : 1 500 000 [Metallogenic map of the BAM region. Scale 1 : 1 500 000]*. Leningrad: VSEGEI Publ., 140 p. [in Russian].

19. Bogdanov, Ju. V., & Rundkvist, D. V. (1982). *Karta strukturno-metallogenicheskih zon territorii SSSR [Map of the structural-metallogenic zones of the USSR. Ministry of Geology and Mineralogy of the USSR]*. Leningrad: VSEGEI Publ.

20. Voznesensky, V. D., Nenashev, Yu. P., Burde, A. I., & et al. (1986). *Instrukcija po organizacii i proizvodstvu geologos#emochnyh rabot i sostavleniju Gosudarstvennoj karty SSSR masshtaba 1 : 50 000 (1 : 25 000) [Instruction on principal geologic surveying work and execution of the USSR State Maps at 1 : 50 000 (1 : 25 000) scale]*. Leningrad. Mingeo USSR, 243 p. [in Russian].

21. Krivtsov, A. I., Samonov, I. Z., Filatov, E. I., Fominykh, A. F., & Shabarshov, P. Y. (1985). *Spravochnik po poiskam i razvedke mestorozhdenij cvetnyh metallov [Reference book on prospecting and exploration of non-ferrous metal deposits]*. Moscow: Nedra Publ., 324 p. [in Russian].

22. Krivtsov, A. I. (2010). *Methodological bases of predictive-metallogenic constructions. Mineral'nye resursy Rossii. Jekonomika i upravlenie [Mineral Resources of Russia. Economy and Management]*, 1, 45–48 [in Russian].

23. *Metallogenicheskij kodeks Rossii [Metallogenic Code of Russia]*. (2012). Moscow: Geokart-GEOS Publ., 124 p. [in Russian].

24. Digital catalog of the State Geological Maps of the Russian Federation at 1 : 1 000 000 scale (third generation). VSEGEI. (n. d.). Retrieved from https://vsegei.ru/ru/info/pub_ggk1000-3/index.php (accessed September 26, 2021).

25. Digital catalog of the State Geological Maps of the Russian Federation at 1 : 200 000 scale (second generation). VSEGEI. (n. d.). Retrieved from http://geo.mfvsegei.ru/200k/ (accessed September 26, 2021).

26. Lurie, M. B., Tokavishchev, I. A., Loginov, D. S., & et al. (2016). To prepare a set of medium-small-scale prognostic-mineralogical maps of solid minerals for the Baikal-Amur group of metallogenic provinces on the basis of multidimensional interpretation of geological, geophysical and geochemical data. Object 1210-4. Report under the State contract No. 11/2014 of December 11, 14. Moscow: PANGEA JSC Publ., 1037 p. [in Russian].

27. Gosgeolkart-200 and Gosgeolkart-1000 software tools. VSEGEI. (n. d.). Retrieved from https://vsegei.ru/ru/info/normdocs/prog_ggk200-ggk1000/index.php (accessed 26.09.2021).

28. Loginov, D. S. (2021). Application of computer technologies and their potential to develop geophysical mapping. *Geodeziya i kartografiya [Geodesy and Cartography]*, (7), 9–20. doi: 10.22389/0016-7126-2021-973-7-9-20 [in Russian].

29. SOBR Rosnedra information system. Federal Agency on Subsoil Use (Rosnedra). (n. d.). Retrieved from https://gis.sobr.geosys.ru/ (accessed 26.09.2021).

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