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Gold deposits and mineralization studies: A 2018-2022 Scopus-based bibliometric analysis

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Research Article

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ABSTRACT

Gold is an important source of economic development and international relations. The accumulation of this element and the formation of deposits is an urgent research problem. The variety of types of deposits, conditions of their formation, and methods of deposit development are of interest to many researchers. Thus, in order to understand the demand for this area, a bibliometric analysis was carried out using the keywords "gold deposits" and "gold mineralization" for a five-year period. The database was acquired from the Scopus and included 793 articles from 77 countries. Statistical analysis was done using the VOSviewer and Mapchart software. Among top publishing countries China, Australia, and Canada took the highest ranks. Top 3 authors stand out as having a high H-index, which indicates their high qualifications in this field. The most popular journal publishing these studies is Ore Geology Review with 259 publications. However, the most cited articles are published in Mineralium Deposita, Economic Geology, Geological Journal, Gondwana Research, Earth-Science Reviews, Geoscience Frontiers, and Geochimica et Cosmochimica Acta. All of these journals are related to Earth and planetary sciences. The large gold mining provinces of China, Australia, and Canada are a key factor in the high publication rate among researchers.

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1. Introduction

Gold is one of the elements in the geological history of the Earth that can concentrate large quantities suitable for extraction (Goryachev, 2019). At present, the reasons for the formation of large deposits and belts with a predominance of one or more metals remain unclear. Possible reasons may be the distribution of metal concentrations, favorable redox conditions, and other parameters. Understanding these reasons is the subject of a significant and complex series of studies and is essential for planning the exploration of new fields (Sillitoe, 2008; Vural and Safari, 2022). Gold is found in different types of deposits and conditions. Over the last decade, there has been significant progress in the identification, classification, and characterization of gold deposits, leading to a better understanding of the main types of deposits (Nguimatsia et al., 2017).

Gold is an important and valuable resource for international, political, and economic relations (Vural, 2020). A deeper understanding of the origins of gold will ensure the full and efficient use of this resource, which will improve the well-being of the country (Shawe, 1988). Successful exploration of gold deposits is impossible without scientifically based forecasts, the reliability of which can be significantly increased by developing integrated methods for exploring gold deposits and creating classifications based on them

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(Savva et al., 2022). The classification of gold deposits provides the basis for resource estimation studies and the development of exploration strategies to evaluate prospects (Robert et al., 1997). Over the past 15 years, a significant amount of new gold mining data has been discovered, confirming the wide diversity of gold deposit types. To consistently classify gold deposits, it is necessary to generalize and synthesize information, as a result, 16 types were identified (Robert et al., 1997). Also, Kreyter V.M. and his followers worked on the classification of geological and industrial types. Thus, the geological-industrial type of deposits are deposits united by a similar material composition of ores and genesis, as well as belonging to certain formations (Kreyter, 1968; Robert et al., 1997; Groves et al., 1998; Konstantinov et al., 2007; Titley and Zurcher, 2008; Nguimatsia et al., 2017; Shapovalov, 2019).

Gold is fundamentally found in native shape, ordinarily alloyed with Ag, and in a few cases with Cu, Hg or Pd, and the diverse amalgam compositions of gold may be characteristic of distinctive sources of mineralization (Morrison et al., 1991; Knight et al., 1999; Chapman et al., 2009, 2017). Searching for gold is a labor-intensive and time-consuming process. The depletion of the world's shallow deposits leads to a decrease in its supply on the market, respectively, to an increase in its demand and price (Nguimatsia et al., 2017). Thus, mining companies have increased their interest in the prospecting and exploration of gold deposits. To solve this problem and search for new areas and deposits, mining enterprises conduct researches to characterize and classify the deposit, both to facilitate the search for new deposits and to exploit existing ones (Nguimatsia et al., 2017).

Researchers all over the world are conducting gold-related investigations. Many research articles have been written by researchers from China (Wang et al., 2019, 2022; Liu et al., 2020), Australia (Jia et al., 2020; Dunga et al., 2021; Wilkins and Quayle, 2021), Russia (Chernykh, 2019; Milovsky et al., 2019; Nagornaya et al., 2020), the USA (Huff et al., 2020; Mercer, 2021; Taylor et al., 2022), Africa (Fuchs et al., 2021; Mvile et al., 2021; Perret et al., 2021), India (Mishra et al., 2018; Sahoo et al., 2018; Chinnasamy et al., 2021), and Japan (Faye et al., 2018; Hattori and Kano, 2019; Sorulen et al., 2019). For instance, Chinese researchers are studying the age and genesis of Early Cretaceous igneous rocks at the Yongxin deposit (Z. Zhao et al., 2019), Paleoproterozoic Mineralization of the Lijiapuzi Gold.

Deposit in the Liaodong Peninsula, (Y. Zhao et al., 2022), the structural characteristics and control of mineralization on the Tibetan Plateau (X. Zhao et al., 2019), and the geology and genesis of the Unkurtash intrusion-related gold deposit in Kyrgyzstan (X. Zhao et al., 2022). Egyptian researchers are studying geochemistry, geochronology, and gold mineralization in the eastern desert (Zoheir et al., 2019*a*, 2019*b*, 2019*c*, 2019*d*, 2020). Russian researchers are engaged in the composition of ore-forming fluids in Primorye (Stavrova et al., 2020), geophysical research to identify ore-controlling structures (Solovyov et al., 2019), the conditions for the formation of mineralization in Yakutia (Sivkov et al., 2021), and the characteristics of placer gold in Transbaikalia (Savichev et al., 2021). Researchers from Australia are also studying rift structures (Thébaud et al., 2018; Ramos et al., 2021), tectonic settings (Thébaud et al., 2018), the formation of gold mineralization (Petrella et al., 2020) and nanoscale research (Kontonikas-Charos et al., 2018).

Bibliometric analysis has become a modern method for processing large volumes of scientific data. This method is popular due to the availability of software for data processing, as well as simple databases such as Scopus, Web of Science, Elsevier, etc (Donthu et al., 2021). In the geological field, bibliometric analysis is also popular and focuses on different areas. Research includes paleontology (Karmaoui, 2022), volcanology (Lerner et al., 2023), mining and mineral processing (Rojas-Sola and Aguilera-García, 2015), remote sensing (Vural et al., 2017; Zhang et al., 2017, 2019; Duan et al., 2020; Wu et al., 2020; Bai et al., 2022), geophysical research (Mulet-Forteza et al., 2020; Zhang et al., 2023), flotation (Lieberknecht et al., 2017), geotourism (Herrera-Franco et al., 2020), the use of artificial intelligence for geological research (Jiang et al., 2022), landslide phenomena (Khasanov et al., 2021; Lima et al., 2022).

Researchers use bibliometric analysis for a variety of purposes. These studies help researchers understand the relevance of the topic, learn something new, and contribute to the development of their field (Donthu et al., 2021). This article analyzes articles from the Scopus database over the past 5 years using the bibliometric analysis method. As a result, an analysis was carried out by the number of publications, research institutions and their relationships, countries, top journals, as well as authors and their collaboration with each other.

2. Materials and Methods

2.1. Data Source

The current research was done using from Scopus database. Two main keywords "gold deposit" and "gold mineralization" were chosen for the analysis. Following searching criteria was applied from the advanced search option: TITLE-ABS-KEY ("gold deposit*" AND "gold mineralization") AND (LIMIT-TO (PUBSTAGE, "final") AND (LIMIT-TO (LANGUAGE, "English") AND (LIMIT-TO (SUBJAREA, "EARTH") AND (LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR, 2022). The total number of publications in the database with these keywords is 793.

2.2. Research Methods

The Scopus database is convenient to use, as it contains a large number of articles, therefore, the research will have a good result (Li et al., 2023). The software VOSviewer (version 1.6.19) (Van Eck and Waltman, 2010) and Mapchart helped to analyze the database.

Database visualization makes it possible to conduct analysis quickly and efficiently. Visualization tools allow you to create high-quality and easy-to-read illustrations.

As shown in Figure 1, the database consists of several sections. In the following sections all databases were used for research (Affiliation, Author, Country, Doctype, Finding sponsor, Source, Subject area, Year).

3. Results

3.1. Number and Type of Publications

As stated earlier, the database contains 793 articles in world studies. The number of publications over the past five years is demonstrated in Figure 2. The figure shows that the number of publications increases every

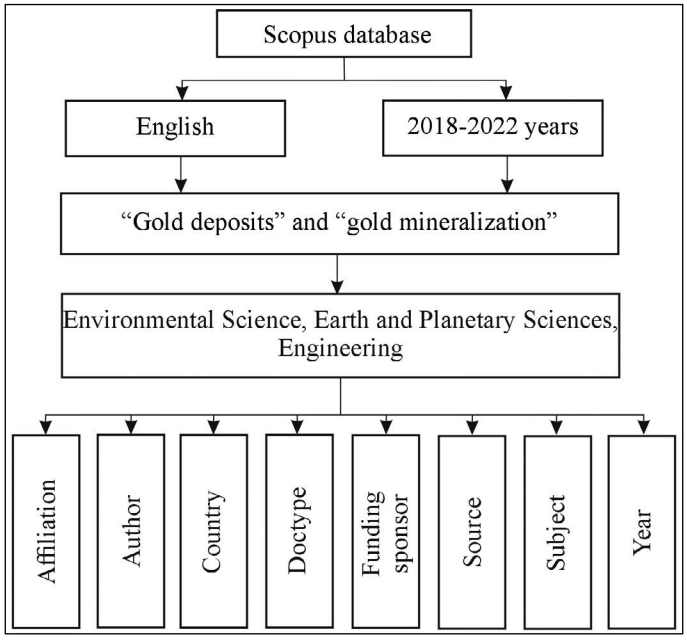

Figure 1- Methodology flowchart for the research.

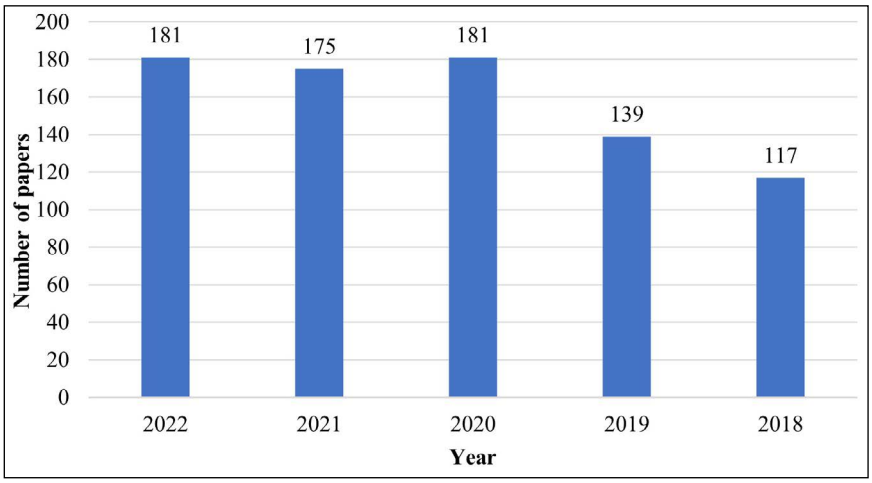

Figure 2- Number of publications by the year on gold deposits and mineralization.

year, however, in 2020 and 2022 it was at the same level.

The ratio by publication type is illustrated in Figure 3. As the figure shows, the largest number of publications is represented by research articles (91.05%). A smaller number of publications belong to conference papers (3.91%) and reviews (3.66%). There are also book chapters, letters, and notes (1.39%).

3.2. Top Authors Publishing Information about Gold Deposits

Researchers, of course, make great contributions to science. The database includes 160 authors who have published their research. The top 16 authors who published the largest number of studies are presented in Figure 4. Statistical analysis illustrates that since 2018 Santosh, M. published 26 research articles in journals included in the Scopus database. Deng. J and Groves, D.I. published 24 and 23 articles, respectively. Other authors, such as Li, S.R., Li, J.W., and Fan, H.R. wrote the same number of articles, 15, which is a third less than the top 3 authors. Yang, L. and Yang, K.F. published 10 research articles.

Using the VOSviewer program, a diagram of the relationship between the authors was constructed. When drawing up the diagram in the settings, the minimum number of documents of an author was

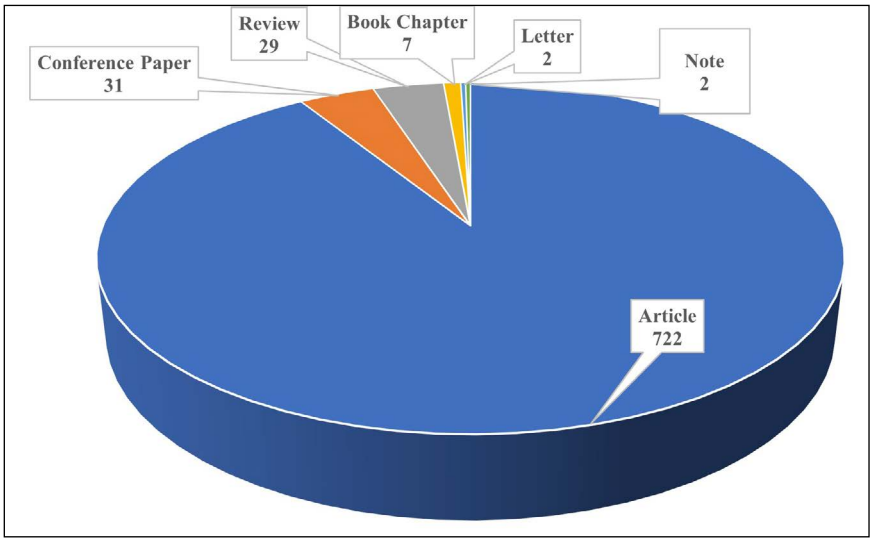

Figure 3- Type of publications on gold deposits and mineralization.

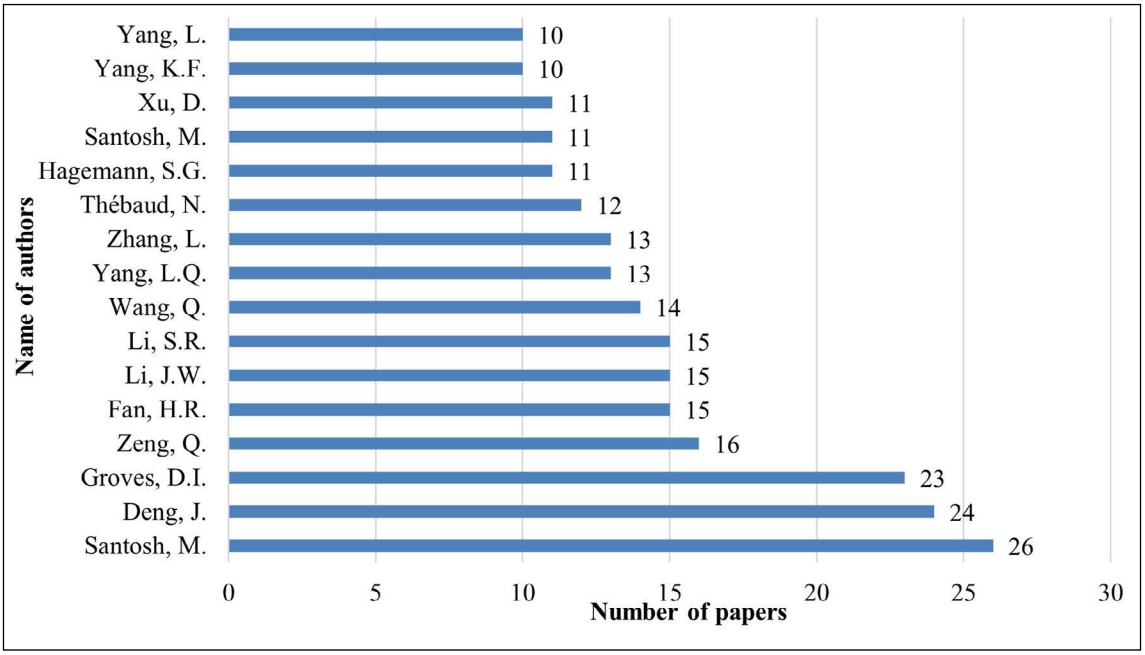

Figure 4- List of top authors on gold deposits and mineralization.

selected 5. Subsequently, there were 143 meet the threshold. For each of the 143 authors, the total strength of the co-authorship links with other authors was calculated. The result was the following relationship (Figure 5).

3.3. Top Countries on Gold Deposits and Gold Mineralization

Statistical analyses were also performed by country. 77 countries used the keywords "gold deposit" and "gold mineralization" in their studies.

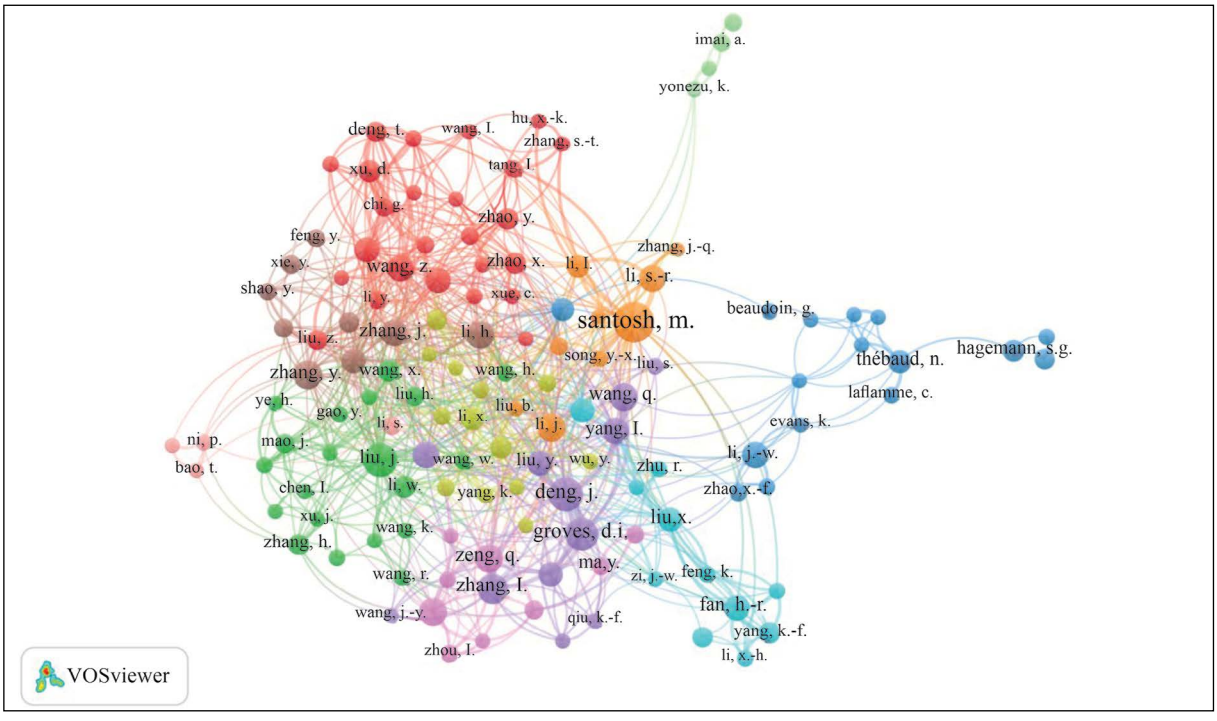

Figure 5- Top highly cited authors on gold deposits and mineralization.

The total number of publications between countries is 1272, of which 1112 publications (87.42%) are from 21 countries, and the remaining percentage comes from other countries (12.58%). The 21 countries with the highest scores for academic productivity are shown in Figure 6. As can be seen from the figure, the most publishing country is China. Over the past 20 years, interest in gold exploration has increased in China due to the importance of the country's economic development (T. Zhou et al., 2002; Zhong et al., 2018; H. Zhou et al., 2019; L. Zhou et al., 2019; X. Zhou et al., 2019; 2022; Z. Zhou et al., 2019; 2022; Y. Zhou et al., 2021). This is confirmed by the figures, since in China researchers published 407, 2.46 times more than Australia, which is in second place. During this time, 100 publications were published in Canada and 76 in Russia. In other countries, the number of publications is small.

The relationship between countries is shown in Figure 7. To construct the figure, the following parameters were chosen: A minimum number of documents of a country 4, as a result, there were 82 countries, and the threshold was chosen equal to 40. The figure also confirms that Chinese, Australian, Canadian, and Russian researchers are the most active in this area of research. 407 articles by Chinese researchers have 242 connections and 5278 citations, 163 Australian articles have 187 connections and 2932 citations. Canadian and Russian articles received 98 and 11 connections and 816 and 258 citations, respectively.

3.4. Top Organizations Publishing Articles and Funding Sponsors

In total, 160 scientific institutions have published their research since 2018. As discussed in the previous subsection, the most publishing country is China. This is confirmed by the following Figure 8. Researchers from China University of Geosciences wrote 106 publications. The Chinese Academy of Sciences and State Key Lab for Geological Processes and Mineral Resources published almost the same number of papers, 90 and 89, respectively. School of the Earth Sciences and Resources, The University of Western Australia and China University of Geosciences published at a level of 60-70 articles. Russian Academy of Sciences has 45 publications, and The University of Adelaide has 40. Central South University finishes in the top 15 institutes with 39 publications.

Among sponsoring companies, the National Natural Science Foundation of China is the leader, as it has sponsored 246 publications. The National

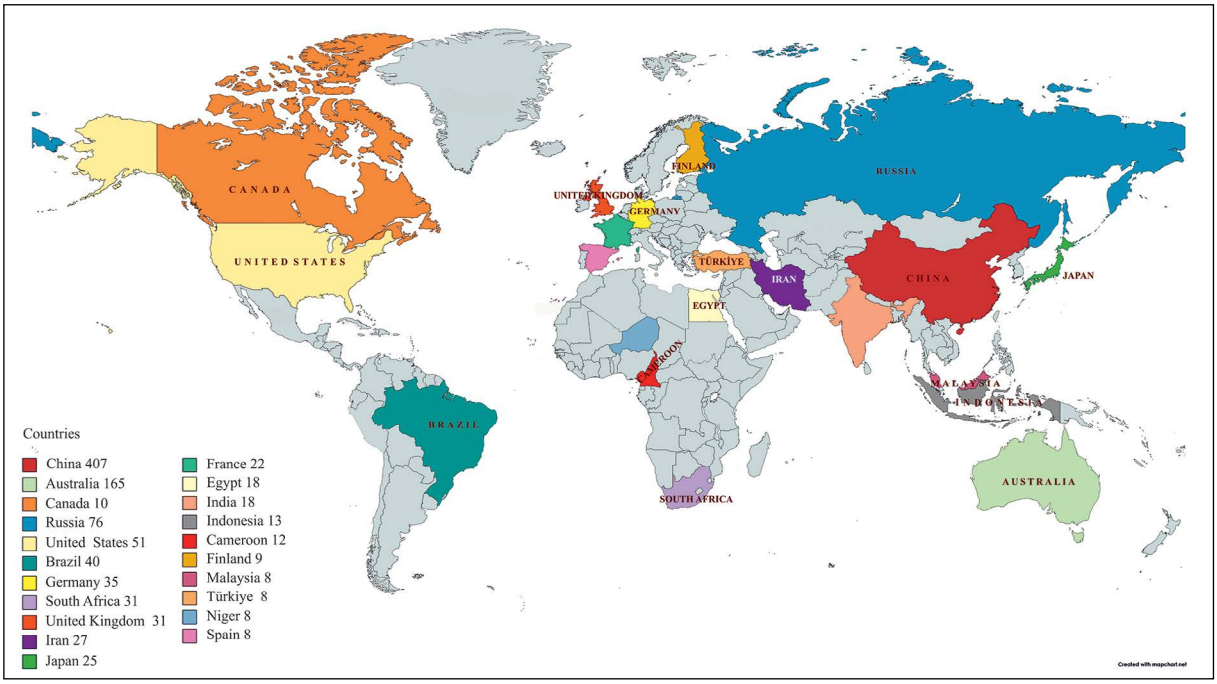

Figure 6- Distribution of the top 21 countries with publications on gold deposits and mineralization.

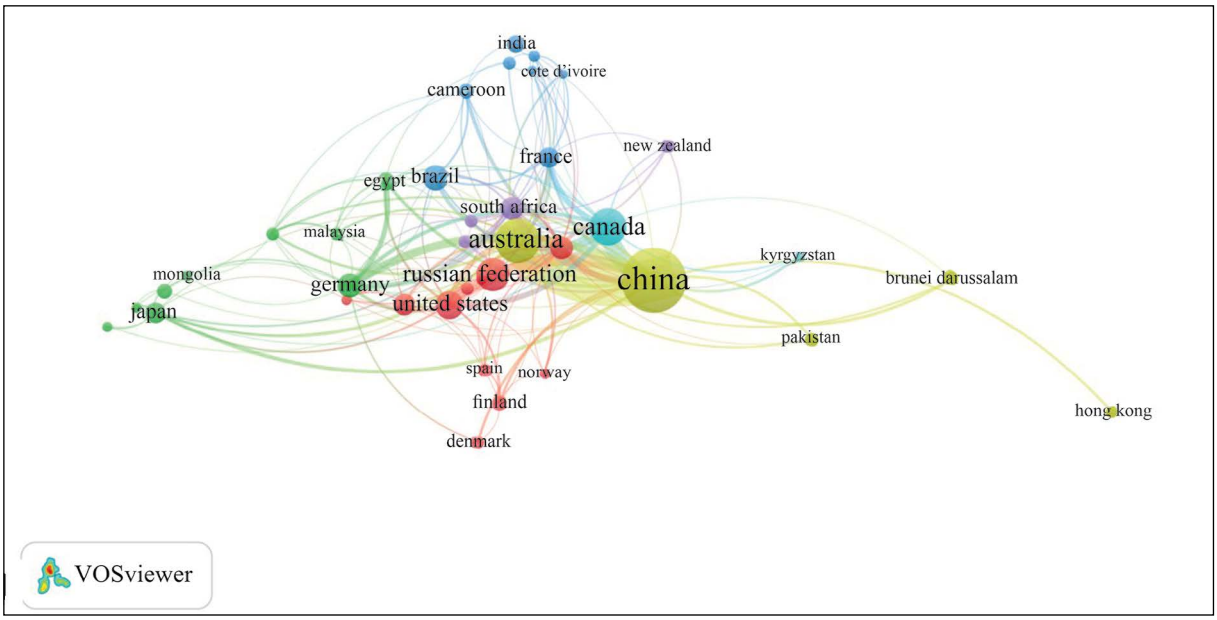

Figure 7- The cooperation network of the most productive countries on gold deposits and mineralization.

Key Research and Development Program of China provided 2 times less sponsorship. The Ministry of Science and Technology of the People's Republic of China sponsored 72 publications, China Geological Survey 58. Fundamental Research Funds for the Central Universities, China University of Geosciences, Wuhan, sponsored 40-60 publications. Higher Education Discipline Innovation Project, Natural Sciences and Engineering Research Council of Canada, National Basic Research Program of China (973 Program), Chinese Academy of Sciences sponsored an average of 25 publications. About 20 publications were sponsored by the China Postdoctoral Science Foundation, China Scholarship Council, State Key Laboratory of Geological Processes and Mineral Resources, Conselho Nacional de Desenvolvimento Científico e Tecnológico, Russian Foundation for Basic Research (Figure 9).

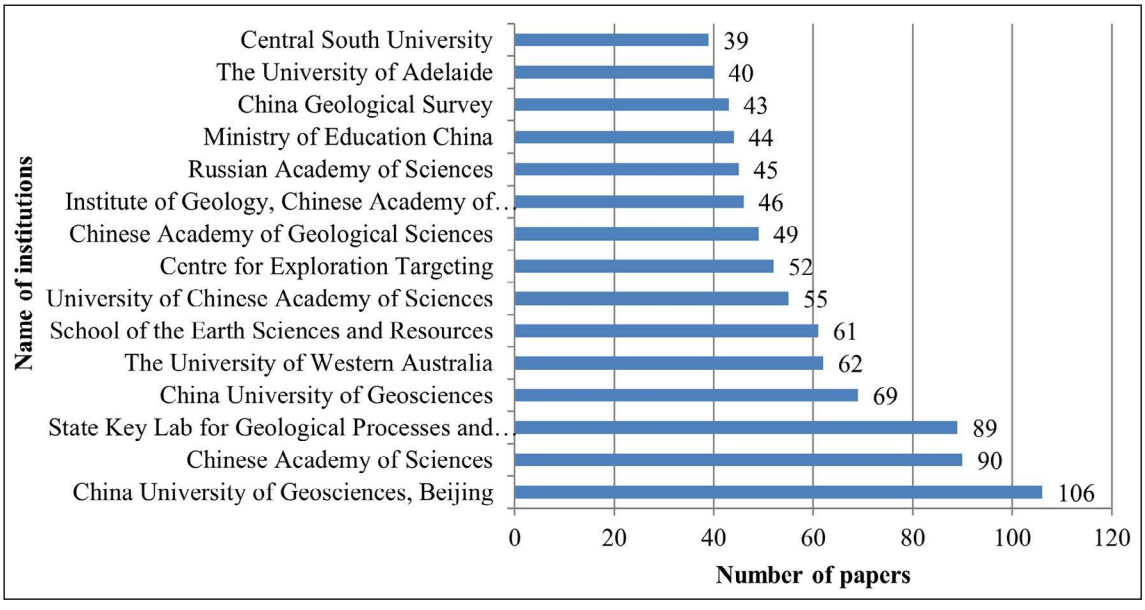

Figure 8- List of top 15 institutions publishing on gold deposits and mineralization.

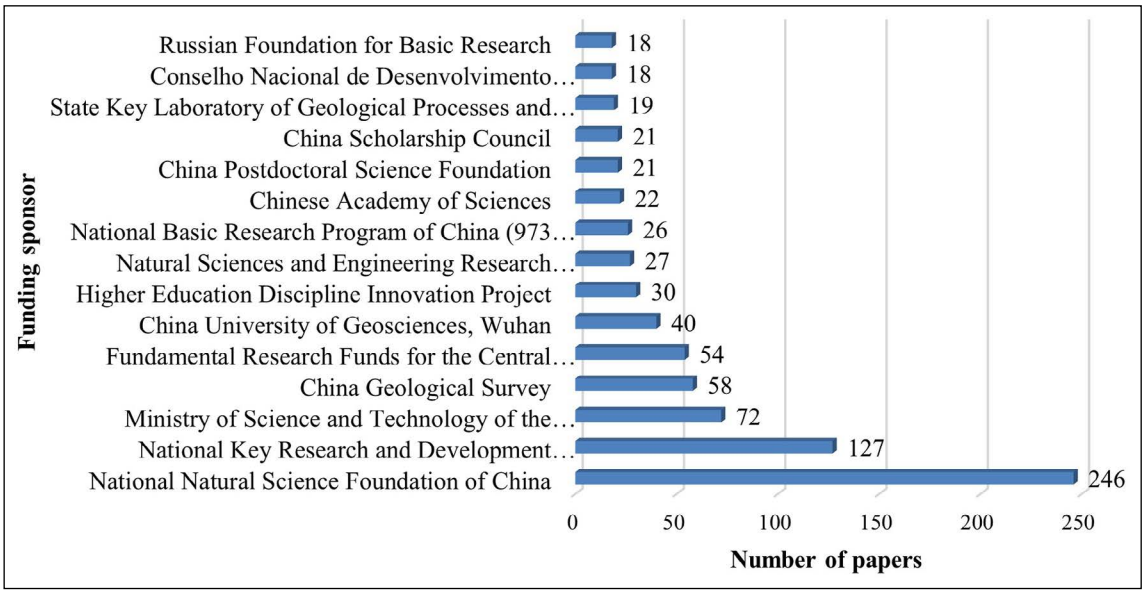

Figure 9- List of top funding sponsor on gold deposits and mineralization.

3.5. Keyword Analysis

Using the program VOSviewer a keyword ratio was created. When analyzing the minimum occurrence frequency of keywords was set as 50. After human error correction and screening, 5094 keywords were formed, and 546 complex association network lines were formed between each keyword. The larger the keyword circle is, the higher the frequency of its appearance. For each of the 49 keywords, the total strength of the co-occurrence links with other keywords was calculated. The result was 4 clusters: The first had 18 keywords, the second and third had 12 keywords, and the fourth had 7 keywords. The result was the following relationship (Figure 10).

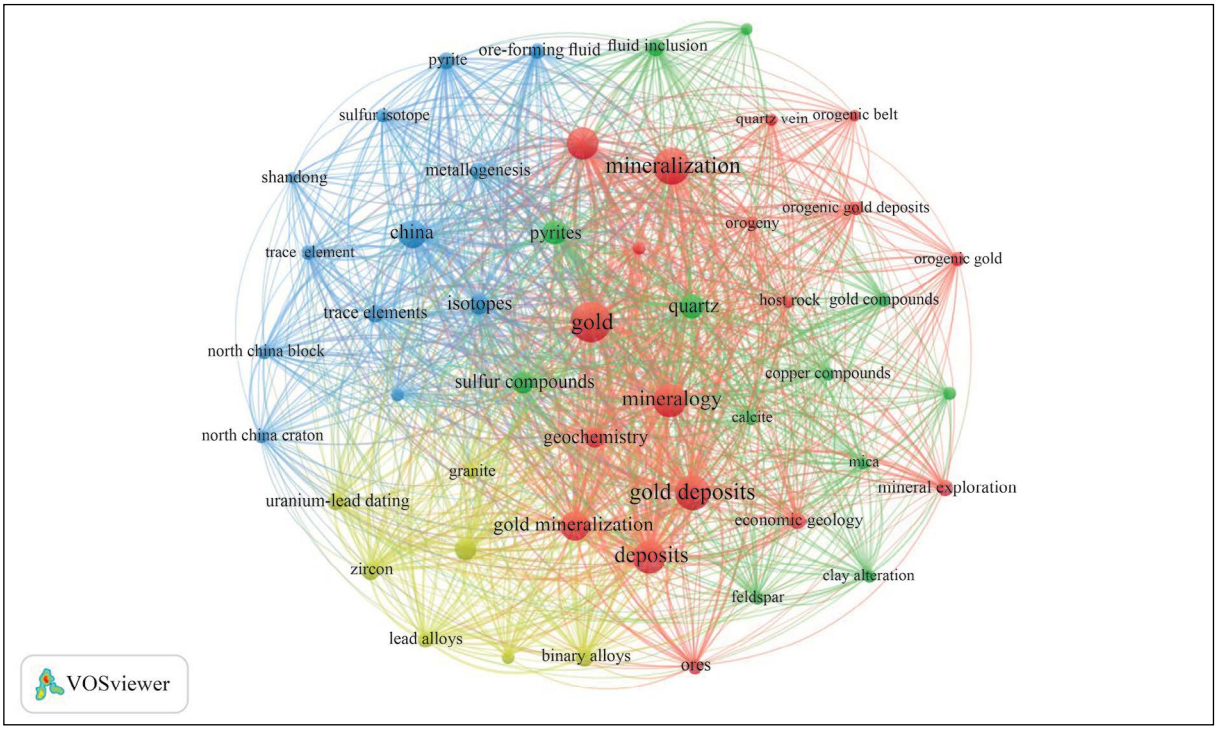

Figure 10- Keyword co-occurrence network diagram on gold deposits and mineralization.

3.6. Mainstream Journals Publishing about Gold Deposits

Among the top journals for publications on gold deposits and gold mineralization, the journal Ore Geology Reviews is in the first place. The number of publications over the past 5 years in this journal is 259. In the Minerals journal, 196 articles were less. In the journals Economic Geology, Mineralium Deposita, Geological Journal, and Journal of Geochemical Exploration, the number of publications is 28-37 articles. In other journals, the number of publications varies from 12 to 14 (Figure 11).

The purpose of the Ore Geology Reviews journal is to publish articles in the field of the geology of ore and non-metallic minerals; land and ocean research; economic geology, exploration, and mining; mineralogy, petrography, petrology, petrogenesis; regions and belts; laboratory, field, and geological (including stratigraphic, structural, remote sensing) studies; geochemical, geophysical and mathematical research methods.

Minerals journal covers the broad fields of mineralogy, mineral geochemistry and geochronology, economic mineral resources, mineral exploration, innovative mining techniques, and advances in mineral processing. Economic Geology, Mineralium Deposita, Geological Journal, and Journal of Geochemical Exploration accept publications in the fields of Economic Geology, Geochemistry and Petrology, Geology and Geophysics.

3.7. Top Cited Papers by Authors

Citation analysis is performed to determine the importance of a publication. This analysis helps authors and researchers understand how popular the research topic is and whether it is of interest to researchers (Li et al., 2023).

Analyzing the citations of articles in Table 1 where the name of the article, year, name of the journal, and the number of citations of this article are shown. Here we can see that the most cited article is an article “A holistic model for the origin of orogenic gold deposits and its implications for exploration” in the journal Mineralium Deposita with 195 citations. Less cited is the article “An integrated mineral system model for the gold deposits of the giant Jiaodong province, eastern China” in the journal Earth-Science Reviews. There are only 2 fewer citations in the article “In situ dating of hydrothermal monazite and implications for the geodynamic controls on ore formation in the Jiaodong gold province, eastern China” in a journal Economic Geology with 159 references. The article “Metal remobilization and ore-fluid perturbation during episodic replacement of auriferous pyrite from an epizonal orogenic gold deposit” in the journal Geochimica et Cosmochimica Acta is in 10th place with 64 links.

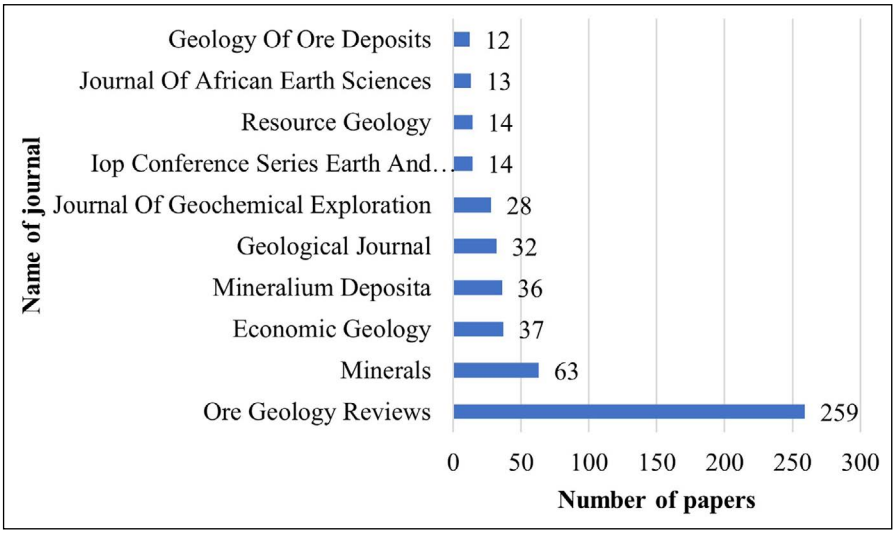

Figure 11- Top 10 Journals by number of publications on gold deposits and mineralization.

Table 1- Top10 cited publications.

Title of the publication	Year	Journal name	Number of citations
A holistic model for the origin of orogenic gold deposits and its implications for exploration (Groves et al., 2020)	2020	Mineralium Deposita	195
An integrated mineral system model for the gold deposits of the giant Jiaodong province, eastern China (Deng et al., 2020*c*)	2020	Earth-Science Reviews	161
In situ dating of hydrothermal monazite and implications for the geodynamic controls on ore formation in the Jiaodong gold province, eastern China (Deng et al., 2020*a*)	2020	Economic Geology	159
Remobilization of metasomatized mantle lithosphere: a new model for the Jiaodong gold province, eastern China (Deng et al., 2020*b*)	2020	Mineralium Deposita	119
Mesozoic Orogenic Gold Mineralization in the Jiaodong Peninsula, China: A Focused Event at 120 ± 2 Ma during Cooling of Pregold Granite Intrusions (Zhang et al., 2020)	2020	Economic Geology	106
Ancient deep roots for Mesozoic world-class gold deposits in the north China craton: An integrated genetic perspective (Yang and Santosh, 2020)	2020	Geoscience Frontiers	89
Regional structural control on the distribution of world-class gold deposits: An overview from the Giant Jiaodong Gold Province, China (Deng et al., 2019)	2019	Geological Journal	86
Ore-forming processes of the Daqiao epizonal orogenic gold deposit, west Qinling orogen, China: Constraints from textures, trace elements, and sulfur isotopes of pyrite and marcasite, and raman spectroscopy of carbonaceous material (Wu et al., 2018)	2018	Economic Geology	83
Decratonic gold mineralization: Evidence from the Shangzhuang gold deposit, eastern North China Craton (Cai et al., 2018)	2018	Gondwana Research	77
Metal remobilization and ore-fluid perturbation during episodic replacement of auriferous pyrite from an epizonal orogenic gold deposit (Wu et al., 2019)	2019	Geochimica et Cosmochimica Acta	64

The relationship between the titles of the articles was also built. For construction, the minimum number of repetitions was chosen - 10, resulting in 2895 matches and a threshold equal to 24 titles. The most common words in publication titles are "Mineralization" and "Orogenic gold deposit" (Figure 12).

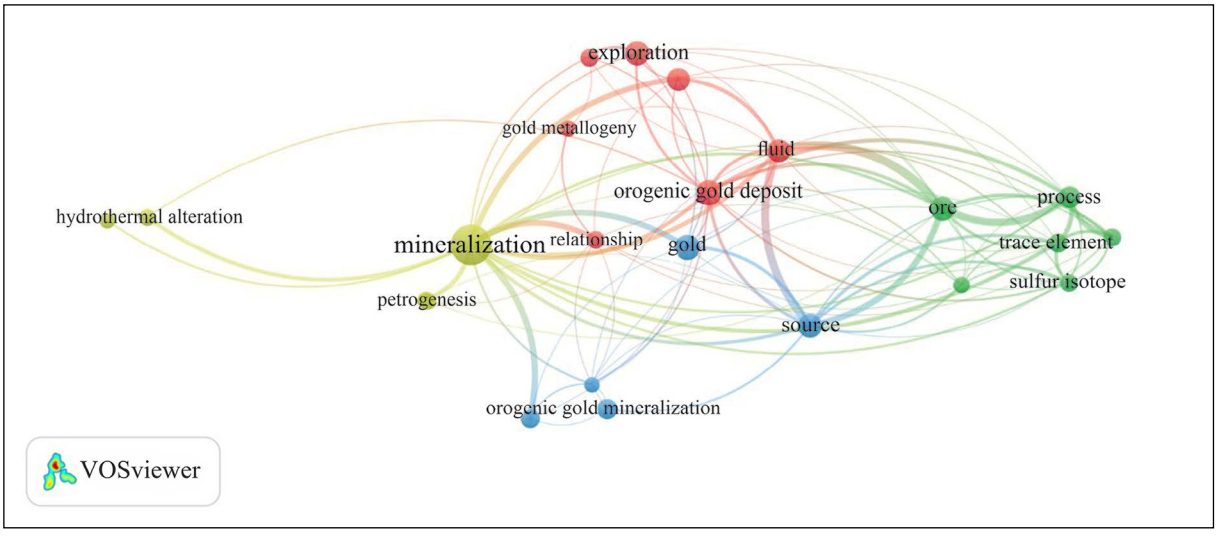

Figure 12- The relationship between the titles of the articles on gold deposits and mineralization.

4. Discussion and Conclusion

By analyzing the number of citations of articles, you can determine the quality and novelty of scientific research (Jumaniyazov et al., 2023). This section provides a citation analysis for the 10 most cited articles for the period 2018-2022. The analysis was carried out in 5 sections: The title of the article, the area of research, the number of publications, the country, and the number of citations of the article (Table 2).

The Table 2 illustrates that Chinese researchers are the most active, but Canadian and Australian researchers are not far behind them. According to statistics, Chinese researchers cited the work data

Table 2- List of top 10 cited publications by authors and subjects in the world.

№	Name of article	Subject area	Number of publications	Country	Number of citations
1	A holistic model for the origin of orogenic gold deposits and its implications for exploration	Earth and planetary sciences Environmental science Engineering	200 12 9	China Australia Canada Germany United Kingdom	129 41 27 10 10
2	An integrated mineral system model for the gold deposits of the giant Jiaodong province, eastern China	Earth and planetary sciences Computer Science Material Science	174 7 7	China Australia Canada United Kingdom	176 25 11 8
3	In situ dating of hydrothermal monazite and implications for the geodynamic controls on ore formation in the Jiaodong gold province, eastern China	Earth and planetary sciences Material Science Computer Science	168 4 2	China Australia United States Canada	166 26 7 8
4	Remobilization of metasomatized mantle lithosphere: a new model for the Jiaodong gold province, eastern China	Earth and planetary sciences Environmental science Material Science	126 3 2	China Australia Hong Kong	124 24 5
5	Mesozoic Orogenic Gold Mineralization in the Jiaodong Peninsula, China: A Focused Event at 120 ± 2 Ma during Cooling of Pregold Granite Intrusions	Earth and planetary sciences Environmental science Computer Science	114 4 2	China Australia Canada	115 15 4
6	Ancient deep roots for Mesozoic world-class gold deposits in the north China craton: An integrated genetic perspective	Earth and planetary sciences Economics, Econometrics and Finance Environmental science	90 1 1	China Australia Japan South Korea South Africa	87 56 9 7 5
7	Regional structural control on the distribution of world-class gold deposits: An overview from the Giant Jiaodong Gold Province, China	Earth and planetary sciences Environmental science Material Science	87 5 5	China Australia Canada	85 16 5
8	Ore-forming processes of the Daqiao epizonal orogenic gold deposit, west Qinling orogen, China: Constraints from textures, trace elements, and sulfur isotopes of pyrite and marcasite, and raman spectroscopy of carbonaceous material	Earth and planetary sciences Engineering Computer Science	84 3 2	China Australia Canada	77 20 10
9	Decratonic gold mineralization: Evidence from the Shangzhuang gold deposit, eastern North China Craton	Earth and planetary sciences Environmental science Material Science	80 2 2	China Australia France South Korea	77 17 5 5
10	Metal remobilization and ore-fluid perturbation during episodic replacement of auriferous pyrite from an epizonal orogenic gold deposit	Earth and planetary sciences Environmental science Chemical Engineering	63 2 1	China Australia Hong Kong Canada France	56 15 5 7 5

1092 times (73.04%), Australian researchers 255 (32.49%), and Canadian researchers 72 (4.82%). The rest of the countries compared to China, Australia, and Canada 76 times (5.08%).

The journal Mineralium Deposita in which articles 1 and 4 were published is published by Springer Nature. This journal is German and has been in the Scopus database since 1966. The magazine's Cite Score is 11.1 for 2022 and is in Q1. Earth-Science Reviews, published by Elsevier, is a Dutch journal and has been listed in the Scopus database since 1966. It published 2 articles "An integrated mineral system model for the gold deposits of the giant Jiaodong province, eastern China". Has a Cite Score of 20 and is included in Q1. The American Journal Economic Geology published by the Society of Economic Geologists, Inc. is included in Q1 and has a Cite Score of 8.8. This journal published 3, 5 and 8 articles. In the Scopus database since 1905. Geoscience Frontiers is a relatively new journal (included in the Scopus database since 2010), with a Q1 and Cite Score of 15.3. The publisher of the journal is China University of Geosciences (Beijing) and Peking University. The English Geological Journal has a slightly lower rating (Q2). It is published by Wiley-Blackwell and has a Cite Score of 4.2. The database lists excerpts from 1951 to 1954, 1956 to 1957, and 1961 to the present. The Journal of Gondwana Research is an American journal published by Elsevier. It has been listed in the Scopus database since 1997, and has a Q1 and a Cite Score of 10.4. The latest journal Geochimica et Cosmochimica Acta has a Q1 and a Cite Score of 9.4. It is an English publishing house of Elsevier and has been listed in the database since 1950.

As can be seen in Figure 4, 3 authors are very active in scientific research. For example, Groves, David Ian has 327 publications (434 co-authors), including international collaborations (91.3%). H-index is 76. Santosh, M.Warrier has 1323 publications (2028 co-authors) with H-index of 122. Also works closely in international collaboration (86.8%) and academic collaboration (1.4%). Deng, Jun has 274 publications (540 co-authors) with an H-index of 61. He is no less active in international (52.5%) and academic (1.9%) collaboration.

The authors of the first article entitled "A holistic model for the origin of orogenic gold deposits and its implications for exploration" (Groves et al., 2020) are Australian and Chinese researchers David I. Groves, M. Santosh, Jun Deng and others. The article talks about orogenic deposits and methods for their formation. For many years, there has been debate among researchers about the origin of these deposits. Two variants of formation are given: 1 – weathering of deep supracrustal strata and 2 – model with the participation of a subcrustal source (Wyman et al., 2016). Jiaodong Province potentially belongs to the second model of orogenic deposit formation.

The authors of the second article, "An integrated mineral system model for the gold deposits of the giant Jiaodong province, eastern China" (Deng et al., 2020*c*) are also representatives of China and Australia. The article talks about the huge Jiaodong gold province and also about the disputes about the source of this gold. The deposits of Jiaodong Province are located in granite intrusions and are Precambrian formations. The authors use a mineral systems approach model (Wyman et al., 2016). In addition, the article provides previous models of formation, the tectonic history of the area, and the geodynamic setting, as well as types of mineralization in the province.

The article "In situ dating of hydrothermal monazite and implications for the geodynamic controls on ore formation in the Jiaodong gold province, eastern China" is authored by Chinese, Australian, and American researchers. The study used U-Th-Pb high-precision and sensitive high-resolution ion microprobes (SHRIMP) and U-Pb laser ablation-inductively coupled plasma mass spectrometry (LA-ICP-MS) to determine the age of monazite in the Jiaodong gold deposit (Deng et al., 2020*a*). Early studies are presented, which stated that the ore was formed over several tens of millions of years. New research shows that gold formed over a short period of about 120 million years.

In the article "Remobilization of metasomatized mantle lithosphere: a new model for the Jiaodong gold province, eastern China," the authors present a new model for the formation of the Jiaodong Gold Province. The authors conclude that disputes about

the origin of orogenic deposits in this province arose due to the processes associated with their genesis, which are multi-stage and complex compared to other provinces of the world (Deng et al., 2020*b*).

The article "Mesozoic Orogenic Gold Mineralization in the Jiaodong Peninsula, China: A Focused Event at 120 ± 2 Ma during Cooling of Pregold Granite Intrusions" talks about the Jiaodong gold deposits located along fault contacts of Upper Jurassic granite and metamorphic rocks of Lower Cretaceous granite. The article provides evidence that the deposits are orogenic, not intrusive, but intrusions are good traps for fluids (Zhang et al., 2020).

"Ancient deep roots for Mesozoic world-class gold deposits in the north China craton: An integrated genetic perspective" is an article by Chinese researchers containing information about the North China Craton and factors contributing to the formation of large gold deposits. The authors propose a new genetic model based on an assessment of the isotopic signatures of host Mesozoic igneous intrusions. The model assumes the processing of ancient gold archives in the lower crust generated as a result of subduction, underplating and cumulation (Yang and Santosh, 2020).

"Regional structural control on the distribution of world-class gold deposits: An overview from the Giant Jiaodong Gold Province, China" article by authors (Deng et al., 2019) discusses the importance of exploration of old and new deposits in Jiaodong Province, since the structural evolution of the province is still poor studied.

In the article "Ore-forming processes of the Daqiao epizonal orogenic gold deposit, west Qinling orogen, China: Constraints from textures, trace elements, and sulfur isotopes of pyrite and marcasite, and raman spectroscopy of carbonaceous material," the authors (Wu et al., 2018) characterized the Daqiao deposit, which has a complex paragenesis, consisting of 4 sulfide stages. Trace element analysis using laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) showed low levels of gold and other elements, indicating an anoxic sedimentary environment. Raman spectroscopy analysis showed that the carbonaceous material was poorly crystallized. The result of the study is the conclusion that the deposit has a shallow-crustal epizonal orogenic type associated with orogenic deformation and regional metamorphism.

In the article "Decratonic gold mineralization: Evidence from the Shangzhuang gold deposit, eastern North China Craton," the authors discuss the Shangzhuang disseminated and stockwork-type deposits. Mineralization is represented by hydrothermally altered halos in the host rocks with the intrusion of mineralized veins. There are 4 types of fluid inclusions in the field. Isotopic studies show that the fluids subsequently mixed with meteoric waters. The authors concluded in favor of the decratonic model of the Shanzhuang deposit (Cai et al., 2018).

The latest article "Metal remobilization and ore-fluid perturbation during episodic replacement of auriferous pyrite from an epizonal orogenic gold deposit" belongs to Chinese-Australian researchers. This article provides information on the Daqiao deposit, which used a new combination of methods to remobilize and reconcentrate gold: Laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS), nanoscale secondary ion mass spectrometry (NanoSIMS) and mass spectrometry, secondary ion spectrometry (SIMS) (Wu et al., 2019).

The most popular research area is Earth and Planetary Sciences, accounting for 1186 articles (94.73%). In Natural Sciences, the number of articles is 29 (2.32%), in Engineering 4 (0.32%), in Computer Science 13 (1.04%), in Material Sciences 20 (1.60%). There are also other fields of research here (Economics, Econometrics and Finance, Chemical Engineering), but the number of articles in this field of research is very small.

Considering that gold is one of the most important elements of the earth's crust, its accumulation in the deep-seated structures, the reasons and conditions for the formation of deposits, as well as exploration and production planning, will be relevant for a long time. Search and exploration of gold deposits is a popular direction in the development of the economies of countries.

In this bibliometric analysis, publications from the Scopus database for the period 2018-2022 with the keywords “gold deposit” and “gold mineralization” were analyzed. As the analysis showed, this topic is very popular in the world, since a significant number of articles have been published over the past 5 years. Thus, the following conclusions may be done: in terms of the number of publications, authors, collaborations, and sponsors, Chinese researchers are leaders in this area of research. Nevertheless, in other countries, this topic is also relevant, as evidenced by the number of publications.

By using bibliometric analysis, it became clear that a large number of publications among Chinese, Australian, and Canadian researchers are related to the fact that China has a huge Jiadong gold province, which is of interest to researchers. Quite a few publications are related to gold deposits in eastern Australia. Canadian researchers are exploring the subprovinces of Wawa, Abitibi, and Wabigoon in the Superior province. Thus, it is worth paying attention to other world provinces, especially in Central Asia, where there are low statistics on the publication of gold deposits.

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