The Information System “History of Geology and Mining” as a scientific tool for historians of Earth sciences

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Abstract. The Information System “History of Geology and Mining” is described in this paper. It briefly presents the theory of scientific information in modern IT and the study of history of geology in Russia. The collected scientific information about geoscientists are developed and published at first in online history of the Science information system. The Internet system is the most convenient and useful way to use and develop scientific biographies, bibliographies, photos and other information for research, education and international cooperation in history of sciences.

1. Introduction
General properties of the scientific information are novelty, originality, completeness and objectivity. This information is mainly used for search, collecting, comparing, analysis and distribution. Sources of the information are necessary for the historians of sciences. Modern information data resources are expanding and getting more common in any science. Information technology (IT) helps to fill and develop this content. Work with such databases may become a standard research processes and computer systems allow scientists to avoid the “information barrier” of storage and move to paperless processes and IT [1].

From the information point of view, general science describes it as a complex dynamic, relatively separate system made for the collection, analysis, and production of scientific data [2]. Methods of storing and processing information may also be the subjects and sources of research [3]. Modern scientific information systems with Internet access are a structured set of interrelated components containing accumulated data with the collection of several valuable features, such as relevance, usability, expert assessment and reassessment, as well as the openness in combination with information law. The system combines, organizes, and provides access with search in computer data sources and multimedia files. These information theory statements provide a great opportunity for scientific information systems used as a modern online tool for historians of sciences.

2. Study of the history of geology in Russia
Professor Vladimir Vernadsky (1863-1945, academician since 1912) was the first historian of geoscience in Russia. He studied many problems in the history of scientific knowledge and published papers about scientific heritage and scientific biographies. In 1902, he started a lecture course about the history of natural science at the Imperial Moscow University. He planned to start description of the world history of natural sciences. He was a first chairman of the “Commission for the study of the history of science, philosophy and technology”, then organized the “Commission in the history of scientific
knowledge” in the Russian Academy of Sciences (1921), which was later transformed into the Institute of the history of natural science and technology [4].

Vladimir Obruchev (1863-1956, academician since 1929) published series of issues “History of the geological study of Siberia” (1931-1949) [5]. They were the first collected works about the history of geology in Russia. Obruchev also proposed to set up the Commission of the Geological Study of the USSR (established in 1955). The commission members from more than 80 geological institutions of the USSR Academy of Sciences, the Ministry of Geology, the Ministry of Higher and Secondary Specialised Education, and others took part in this work. They compiled over a million sources and published series called “Geological exploration of the USSR” (1961-1991). It was in 50 volumes (over thousand books) of the annotated bibliographies and reports covered all regions of the USSR [6]. The Commission was based on the Department for the History of Geology, Geological Institute, USSR/Russian Academy of Sciences. The commission was led (since 1958) by a historian of geosciences, Vladimir Tikhomirov (1915-1994), who was the head of the Department and the chief editor of the series.

In 1956, USSR joined the International Union for the History and Philosophy of Science (IUHPS) and created the Soviet National Union of Historians of Science and Technology (now the Russian National Committee for the History and Philosophy of Science and Technology). In 1967, the International Committee for the History of Geological Sciences (since 1980 – the International Commission on the History of Geological Sciences; INHIGEO) was initiated by Tikhomirov (first president, 1967-1976). His idea was to publish 30 volumes of the series “World History of Geological Sciences”. The merits of the contributions of Tikhomirov to the history of geosciences and to the foundation of INHIGEO were recognized by the International Union of Geological Sciences – the IUGS Science Excellence Awards – “V.V. Tikhomirov History of Geology Award” (since 2012) [7].

3. Materials and methods
The above-mentioned Department for the History of Geology was collecting information since 1949, it was the first specialised division in the history of geology as a scientific theme [8, p. 77]. In 1965-1978, eight volumes of series “Materials about the history of geology in the USSR” were published. It was the beginning of production of dictionaries (included only 3 first Russian letters) with geoscientists’ short biographies and bibliographies. The next step was the book series “Essays about the history of geological knowledge” published in 32 volumes (1953-2006).

Information accumulated over the years in papers (forms, reports, letters, autobiographies, event programs, list of papers, correspondence and other publications), photos and other illustrations. Over 2,500 personal folders of scientists are accumulated in our department, also several cabinets with bibliographic cards and photos are collected. All this information was required for processing and digitizing documents for preservation and presentation.

Our goal is to save and publish this information as a source for historians of sciences. The best way to solve this problem was the creation of the online Information System “History of Geology and Mining” [9]. The System is located on URL: http://higeo.ginras.ru (since May, 2019).

The System is based on scientific books’ catalog software platform “SciRus” which was developed by the Library for Natural Sciences, Russian Academy of Sciences [10]. The Department for the History of Geology made a structure of the system and its content, the Library provides IT support.

4. The Information System
Information loaded to the database is connected to the dynamically generated web pages. It combines personal data about scientists and includes biographic notes, links to the organisations where a researcher worked, documents, photos, membership in the Academy of Sciences and other scientific societies. It also includes geography of research, areas of work (according to the “Russian state rubricates of scientific and technical information”), some scientific biography or autobiography, lists of publications, obituaries, papers about scientists and other information.

More than 900 scientists were added to the system in 2019, and the number is still increasing. It is
17th–21st century’s naturalists, geologists, mining and soil scientists, some geographers, and other geoscientists. First of all, we included all academicians, corresponding members and foreign members of the Russian Academy of Sciences, geological and mining departments.

The main advantage of the online information system is integrated search tools, which allow you to find any information. Table 1 shows search options in: scientist’s names, bibliography, documents, personnel, organisations, sources of information, and photos. If you leave search window blank and press “search” (“искать” in Russian) button, then you can see total list of links to persons, documents or photos. The system is also open to main international Internet search engines. Scientists’ names and system interface is added in both Russian and English. Bibliography titles are presented in original European languages (oriental languages are translated to Russian). We use some standard abbreviations in bibliography serial titles and organisations, transcript available.

Table 1. Information System “History of Geology and Mining” online search options

| Documents       | Scientists       | Organizations | Sources | Photos |
|-----------------|------------------|---------------|---------|--------|
| Title (in Russian) | Full name (in Russian) | Original title | Title | Title |
| Original title  | 1st name (in Russian) | Title (in Russian) | Type | Description |
| Document type   | 2nd name (in Russian) | Brief info | Description |
| Document language | Surname (in Russian) | Activities |
| Document year   | 1st name | History |
| References      | Surname |
| Comments        | Centuries (XVII-XXI) |
| Full text       | Date of birth |
| Comments        | Place of birth |
| File (PDF)      | Date of death |
|                 | Place of death |
|                 | Scientific degree |
|                 | Fields of interest |
|                 | Exploration regions |
| Scientific institutions | Biography |
|                 | Bibliography |

The System is also developed to collaborate with colleagues from the INHIGEO in research and bibliographic projects. 27 Russian INHIGEO members are presented in the System.

Table 2 shows the number of organizations and institutions included with lists of associated personnel. Each scientific bibliography and biography has its author-compiler; publications are checked by our editors and updated as content is expanded.
The long-term work of professional bibliographers of the Department for the History of Geology has resulted in hundreds of thousands of bibliographic cards (Russian and foreign), which we process into standard lists of bibliography and place them in the Information System. 50 thousand important cards were scanned for further development.

**Table 2. Information System “History of Geology and Mining” content fills for mid 2019 (with future plans)**

| Documents | Scientists | Organizations | Sources | Photos |
|-----------|------------|---------------|---------|--------|
| 710       | 870        | 460           | 105     | 1,270  |
| (> 10,000)| (> 2,500)  |               |         | (>20,000) |

Documents include original scans (mostly in PDF files) of forms, autobiographies, obituaries, some old newspaper publications, correspondence, manuscripts, programs of the anniversary events, reports, awards, and more historical materials. These online documents may be the first step to review from our information sources, many other documents and papers we cannot publish because of copyright regulation. Then welcome to contact us for further unpublished information about our collection of publications, papers and photos. Our offline history of geoscience information sources includes personal scientist’s files and folders, literature, translations, illustrations, autographs, photographs, and other documents. All of this additional information are available for all forms of cooperation with historians of sciences, researchers and students.

5. Connected information sources

Bibliographies, obituaries, and other titles in our System often contain Internet references (web URL links) to the sites with official publications. In particular, the Information System is closely integrated with the digital library “Scientific Heritage of Russia” (URL: http://e-heritage.ru), created under the program of the Presidium of the Russian Academy of Sciences. It contains over 2,100 publications on geosciences.

We have already scanned about 9,000 photos of geoscientists and mining engineers, over 20,000 more left in paper and film format. Online hidden copy of scanned photos are easy to arrange, classify, tag and search for its description. Some of them as thumbnail pictures gallery we add to the Information System for preview. Digital images may use in exhibitions and publications.

6. Conclusion

Any historians of geosciences can get online Internet access to the Information System “History of Geology and Mining”. They can use it to search and study information about scientists, publications, organisations, sources, etc. It can also serve as a reference database for bibliographies, biographies, publications, images, and documents. Analysing primary sources of information, searching for links, reconstructing the chronology of events are very useful to historians of geosciences. Dates and places of conferences and congresses in publications are included, reviews, editors, discussions, reprints and translations of works added in bibliographies.

Sorting and searching are especially convenient for searching anniversary dates. Since 2017, students of the Geological Faculty of the Moscow State University use the System in the lecture course “History of Geology”. The System already cited in source studies by scientists, museums and in cultural projects. We can see web traffic statistics from last year with 2-6 thousands monthly visitors, mostly from former USSR (in descending order) Russia, Ukraine, Belarus, Kazakhstan, Armenia, and Azerbaijan, but also from Germany, Norway, USA, France, UK, Israel and other countries.

Further development of the “History of Geology and Mining” Information System may be in database expanding with personalities of scientists from around the world, and the inclusion of related
geosciences. While this is the first and only system in the history of science, its future lies in interdisciplinary and integration with future systems and in the expansion of functionality. This will allow turning it into an “expert system” that could analyse and solve with logical forms, global questions of estimation and modelling.

With the future contacts, communications, joint projects, and open sources information exchange, the idea of Vladimir Vernadsky about the “World History of Natural Science”, as well as Vladimir Tikhomirov’s plan to cover the “World History of Geological Sciences”, may come true in open digital format and brake languages, educational, ideological, financial and bureaucratic barriers.

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