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### ABSTRACT

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# Ordovician scientometrics

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Scientometrics is a tool for studying the development of science to observe and analyse patterns that emerge from it. Our aim is to elucidate how the Ordovician has been studied through the years, through the perspective of the published papers, the main topics related to it and how researchers have collaborated along the years, studying Ordovician rocks.

The proposition of a new System 'between' the Cambrian and Silurian rocks was made by Charles Lapworth, researcher at University of Birmingham, by 1879. Only by 1988 the Tremadocian rocks were recognized as Ordovician (and not Cambrian) by the International Union of Geological Sciences (IUGS).

This work uses the OpenAlex database, which contains most of the scholarly information available with metadata of a larger portion of published material in several forms and includes records into that period. In its comprehensiveness, it competes with commercial databases such as Dimensions, Web of Science and Scopus. For all the analysis, we have used a version of OpenAlex included in the Google BigQuery platform available through a public link. The scientometric analysis starts by filtering the papers from the database containing the word 'ordovician' in their titles or abstracts (when available). That selection resulted in 30259 works with publication years ranging from 1871 to 2022. There is a nearly quadratic growth with oscillations starting at 1 and a peak of 1090 works in the year 2009.

As the next step, using information about co-authorship of papers, it is possible to collect the information on author affiliations. This way we establish connections among the institutions in a network. The network reveals that geographically close institutions tend to be more collaborative within one time period.

Chinese institutions are closely connected such as the Chinese Academy of Sciences and China University of Geology. Another group is English speaking countries outside the United States such as the Australian National University and British Geological Survey. There are two large groups that interconnect these first two groups: European and North American institutions represented by the largest – Lund University, National History Museum, Uppsala University. These institutions appear foremost when filtering the network for more than 200 connections (co-authored papers).

Going into further detail, one can see a network with over 100 connections showing Chinese Oil Research Institutions closely linked to their universities. Also, the Chinese institutions connect directly to the European institutions such as Czech Geological Survey and University of Bergen. British universities such as Bristol, Leicester and Durham further serve as a connection point between North America and Europe.

When the connections are split into 30-year time periods, it is possible to note the geographical growth in the Ordovician studies, spreading from traditional centres of knowledge into areas where new universities and institutes are created. In the first two periods of three decades, institutions present no connections.

Starting from 1933 to 1962, three of them appear collaborating: Florida State University, Rice University and Shell Oil. In the period from 1963 to 1992, 412 institutions were connected. For that period, the United States Geological Survey, Geological Survey of Canada, and the Chinese Academy of Sciences come out as hubs of collaboration.

In the last period, 1978 institutions are connected. Recent years show a significant presence of Ordovician studies linked to the oil industry, to the point that, when connected to the higher productivity, oil research institutes dominate the network of connections in the Chinese hub, now linked together around the Chinese University of Geosciences. The British Geological Survey is the most important focal point between Europe, through the National University of Córdoba, and North America, through the Ohio State University.