

SCIENTIFIC PRODUCTION ON THE CLAY MINERAL ILLITE: A BIBLIOMETRIC STUDY

PRODUÇÃO CIENTÍFICA SOBRE O ARGILOMINERAL ILITA: UM ESTUDO BIBLIOMÉTRICO

PRODUCCIÓN CIENTÍFICA SOBRE EL MINERAL ARCILLOSO ILLITA: UN ESTUDIO BIBLIOMÉTRICO

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ABSTRACT

Clays have been present in society since the beginning of civilization, playing an important role in the early development of man. From the moment that man began to acquire knowledge about the material, in which it served him, he began to analyze its behavior and its application. However, he needed to know the raw material and that there was a difference between them in terms of the structural composition of each clay. Therefore, the objective of this work is the bibliometric survey on the illite clay mineral. The methodology was the study of art and was based on the Web of Science survey, with a time interval of 10 years (2011-2022). Within the base of the Web of Science, filters were applied for search refinement, and the term illita was inserted in the English language. Also, in addition to the year, authors with more publications and the main categories of the database were searched. After processing the data, author Zwingmann was the author with the most publications, followed by Hong and soon after Clauer, each with 29, 27 and 26, respectively. The category with the most publications was Geosciences Multidisciplinary, Geochemistry Geophysics and Mineralogy.

Keywords: Rock. Sedimentar. Genesis of Clay.

RESUMO

As argilas estão presentes na sociedade com um papel importante no desenvolvimento da civilização humana. A partir do momento que o homem começou a adquirir conhecimento sobre o material que lhe servia, passou a analisar o comportamento e sua aplicação. No entanto, era necessário conhecer a matéria-prima e as diferenças entre as argilas existentes. Portanto, o objetivo desse trabalho é o levantamento bibliométrico sobre o

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argilomineral illita. A metodologia para a determinação do estado da arte se deu com base na pesquisa na plataforma Web of Science, com intervalo de tempo de 10 anos (2011-2022). Dentro da base da Web of Science foram aplicados filtros para o refinamento de busca, com o emprego do termo illita (illite). Além do ano, foram buscados os autores com mais publicações e as principais categorias da base de dados. Após o tratamento dos dados, o autor Zwingmann foi o autor com mais publicação, seguido pelo Hong e logo em seguida Clauer, cada um com 29, 27 e 26, respectivamente. A categoria com mais publicação foi a Geosciences Multidisciplinary, Geochemistry Geophysics e Mineralogy.

Palavras-chave: Matéria Prima. Sedimentar. Aplicação Industrial.

RESUMEN

As argilas estão presentes na sociedade com um papel importante no desenvolvimento da civilização humana, . A partir do momento que o homem começou a adquirir conhecimento sobre o material que lhe servia, passou a analisar o comportamento e sua aplicação. No entanto, era necessário conhecer a matéria-prima e as diferenças entre as argilas existentes. Portanto, o objetivo desse trabalho é o levantamento bibliométrico sobre o argilomineral illita. A metodologia para a determinação do estado da arte se deu com base na pesquisa na plataforma Web of Science, com intervalo de tempo de 10 anos (2011-2022). Dentro da base da Web of Science foram aplicados filtros para o refinamento de busca, com o emprego do termo illita (illite). Além do ano, foram buscados os autores com mais publicações e as principais categorias da base de dados. Após o tratamento dos dados, o autor Zwingmann foi o autor com mais publicação, seguido pelo Hong e logo em seguida Clauer, cada um com 29, 27 e 26, respectivamente. A categoria com mais publicação foi a Geosciences Multidisciplinary, Geochemistry Geophysics e Mineralogy.

Palabras clave: Materia Prima. Sedimentaria. Aplicación Industrial.

1 INTRODUCTION

Over time, since the beginning of civilization, man sought to improve the technology of the time for better application of clays, which served man in countless ways, such as: storing groceries, water, special oils; in some civilizations, it was used to worship gods, such as in Egypt (source?).

With the advancement of science and technology, the latter from the Industrial Revolution, allowed knowledge about clays to progress and expand the areas of application. One of these areas is red pottery. Clay minerals are minerals that intrinsically define clays; Chemically, they are hydrated aluminum or magnesium silicates and in the presence of water they acquire certain properties that make technological application feasible. It was from this observation, clay became the main component of traditional ceramics in the composition of masses (ABCERAM, 2022).

Clays, therefore, are raw materials for various purposes of technological application. In addition to the use in the area of red ceramics, there are several uses in other sectors such as in the cement manufacturing industry, advanced ceramics, refractory industry, rubber, paints and paper. The modernization of technology and scientific progress have led to the use of clays in the health and cosmetics industries. In the health sector, in the manufacture of ceramic composites, blends with ceramic materials; in dentistry, in the manufacture of veneers. In the area of cosmetology, it is part of makeup products, clay masks to remove toxins and fats.

With the high variability of clay minerals, illite is one of the clay minerals with great technological application. Illite comes from the primary mineral mica that belongs to the group of phyllosilicates, making up a secondary mineral of the 2:1 type that corresponds to two sheets of silicon tetrahedron and one of aluminum octahedron. The chemical composition of illite is $(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,(H_2O)]$ and dioctahedral similar to that of

muscovite with junction of the T-O-T layer (two tetrahedral leaves and one octahedral). Generally, by majority, illites contain fewer atoms between the strata than muscovite generating a weak binding force (ERNANI, 2016; NAVARRO et al., 2017).

As a general objective of this article, a survey was carried out through a bibliometric study identifying the main authors and sectors and/or segments that use illite in the industrial process and thereby verifying the object of study, enabling its use.



2 METHODOLOGY

The bibliometric research started from the study of art with access to the list of collections available on the CAPES journal platform. The basis of the research was the Web of Science, carried out from November to December 2022. The objective of study in this survey was the clay mineral illite with its technological applications. To this end, filters were applied to refine the search based on more relevant and updated data, as shown in Chart 1.

The research began with the use of the clay mineral illite, but the Web of Science database recognizes only terms in English, and illite is used. In order to make the work more refined, the time interval applied was 11 years, from 2011 to 2021. Also, Web of Science categories and authors were searched , and the five most important articles were selected, from which the analysis of the studies of interest was generated.

The discussion of the data took place about each publication of greater importance for each author

Table 1

List of categories and authors

Filters	Data
Web of Sciences journals	<i>Geosciences</i> <i>Multidisciplinary</i> <i>Geochemistry Geophysics</i> <i>Mineralogy</i> <i>Chemistry</i> <i>Physical Energy</i> <i>Fuels</i>
Main Authors	Zwingmann, Horst Hong, Halie Clauer, Nobert Aldega, L Dai, Shifeng

Source: The author, 2022.

3 RESULTS AND DISCUSSION

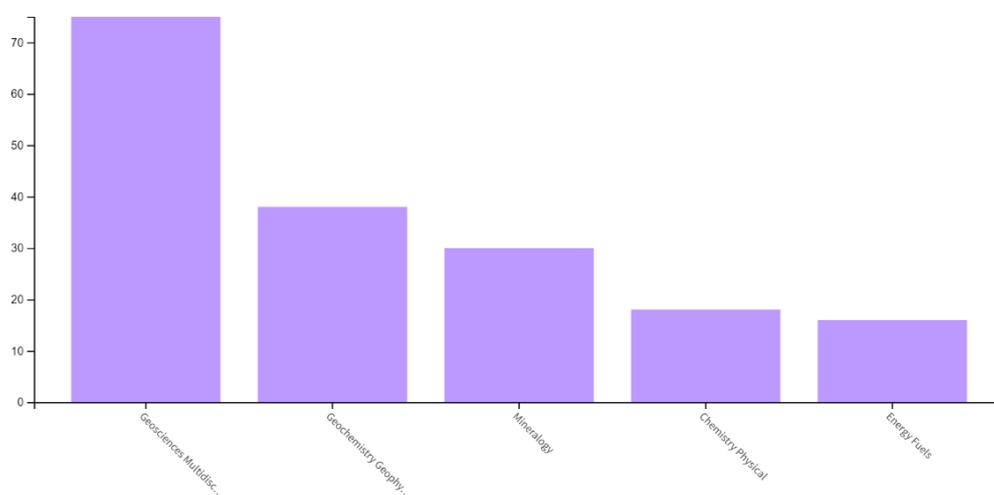
From the search filters used in this research, 126 publications were obtained. The journal with the most publications was Geosciences Multidisciplinary, with 75 papers identified, followed by Geochemistry Geophysics with 38, and then Mineralogy with 30

publications. Figure 1 shows the graph with the number of publications according to the category of the database.

Regarding the time interval employed (11 years), Figure 2 shows the number of publications. The year 2013 presented the highest number of articles with 15, followed by the years 2016 and 2017 which were tied with 14 and soon after the years 2012, 2014, 2015 and 2020, making a result of 12 published works.

Figure 1

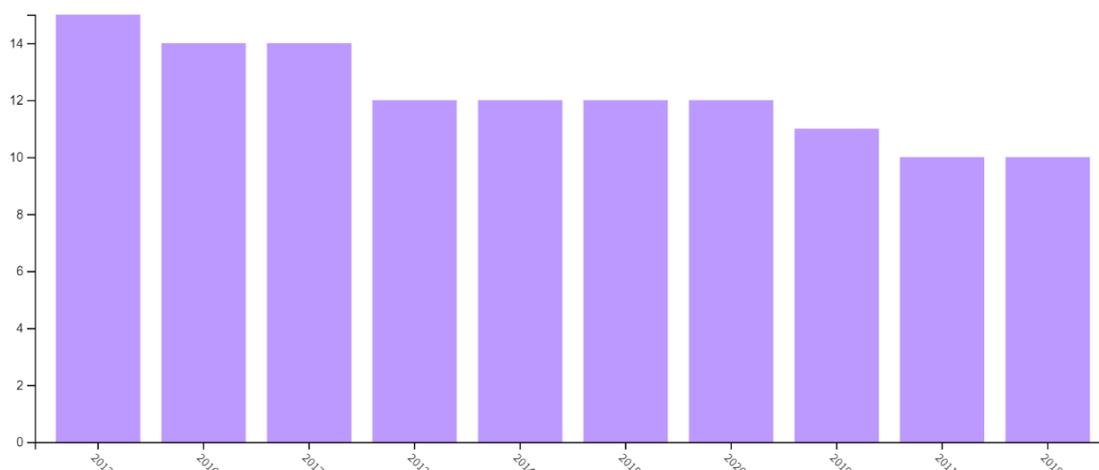
Web of Science category distribution chart



Source: Web of Science, 2022.

Figure 2

Number of publications per year



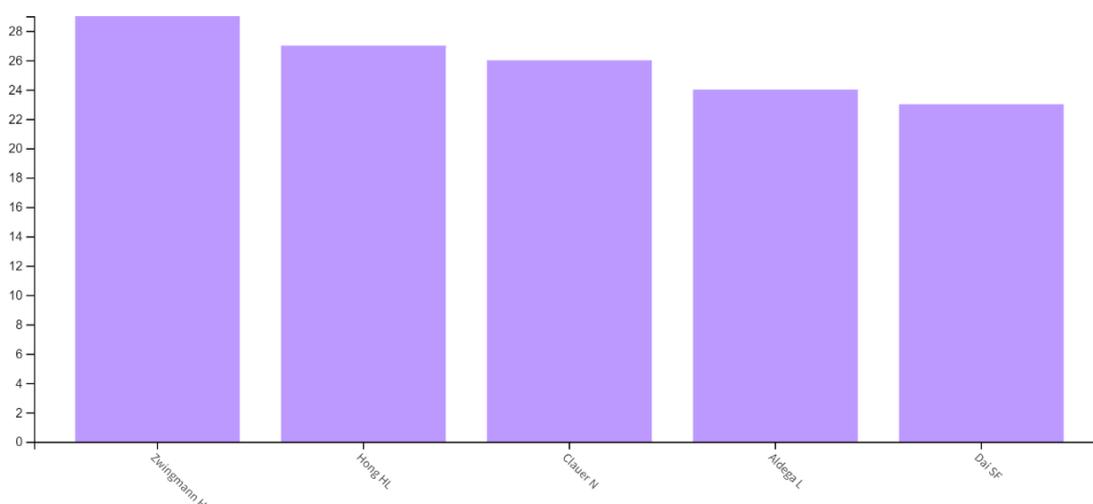
Source: Web of Science, 2022.

The author who presented the highest number of publications in the period surveyed was Horst Zwingmann, with 29 in all. After him, Halie Hong with 27 and then Norbert Clauera with 26 publications. Figure 3 shows the graph with the scientific production of the five authors who published the most.

Figure 4 shows the graph with the curve of citations and publications within the established time interval.

Figure 3

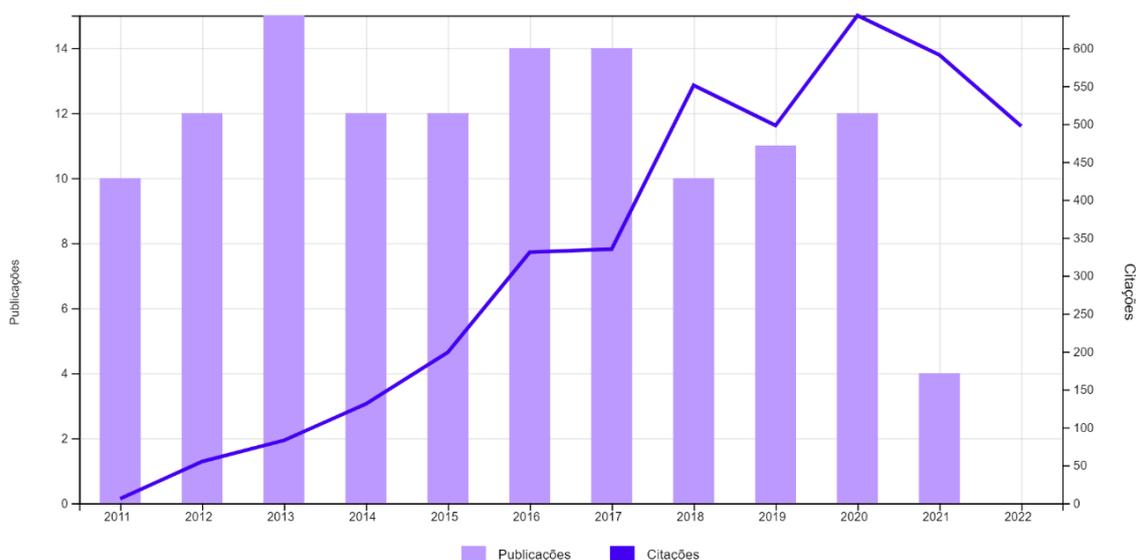
Graph with the number of publications according to each author



Source: Web of Science, 2022.

Figure 4

Graph number of citations X publication



Source: Web of Science, 2022.

According to Figure 3, Zwingmann presented 29 publications, among which Clauer et al., (2012) stand out, which aims to study two dating methods, K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ with illite-type clay minerals. To carry out this research, the authors separated samples ranging in size < 0.2 to $40\ \mu\text{m}$ originated from a set of boreholes in sandstones of the Basin in northwestern Germany. After the analyses, the authors concluded that the conventional K-Ar method is convenient and straightforward for dating clay minerals and it is possible to use this clay mineral in geochronology. This work, according to the database, is within the journal of Geosciences Multidisciplinary and has been cited 55 times, showing its value in the area of geosciences.

The study by Yin et al., (2013) brought an approach to the description of vermiculite intercalated with hydroxyl (HIV) present in the red earth profile in Jiujiang, southeastern China, aiming to understand its genesis. The site is in a subtropical zone, above sea level at around 41 m altitude. The depth of 14 m was subdivided into three sections. After processing the data, the authors concluded that the sedimentary deposit was formed in the Pleistocene period, resulting from the alteration in the HIV clays due to climatic conditions. The exchangeable cations present and the spacing break were due to the ratio of $\text{Al}/(\text{Mg}+\text{Ca})$ as AlOH acting on the HIV interlayers. The HIV clays found in this locality are products of the weathering of the illite, suggesting that the order of weathering was: illite-vermiculite-HIV. The study comprises two journals: Mineralogy, Chemistry Physical.

The author with the most publication, after Hongn, is Norbert Clauer. In total, 26 articles were identified, and their most interesting study was published in 2012. It addresses clay dating by two methodologies (CLAUER et al., 2012).

Aldega totaled 24 publications and among them the most valuable is the study developed in partnership with Rossetti et al., (2011) who proposed a hydrodynamic mathematical model for fluid flow and mineralization as well as the inference of future failures for hydrothermal flow. In addition, the description of the fluid flow mode, rock-fluid interaction and mineralogy within the environment of the extensional fault in the main hydraulic channel for thermal circulation.

The x-ray diffraction technique and the application of geochemical studies, inclusion of fluids and stable oxygen isotopes were used. As a conclusion of the study, the authors point out that the hydrological properties were influenced by the low permeability of the fault core inducing the compartmentalization of the fluid flow and the parallel flow of ascending

fault. The Web of Science category that falls under the study is Geosciences Multidisciplinary (ROSSETTI et al., 2011).

The study by Dai et al., (2011) had a high number of citations, in all 222 and aimed to describe the chemical and mineralogical compositions and possible sources of silic, mafic and alkaline tonsteins as well as magic tuffs below the Upper Permian carboniferous layers. In all, 35 samples of tonstein and 4 samples of magic tuffs from the six coal mines. The mineralogical detection was made by optical microscopy and X-ray diffraction. Therefore, the authors found that the deposits were indeed alkaline, mafic, and silicon, in which the first two correspond to the initial and final stage of the Permian and the mafic tonsteins are distributed throughout the section

Carboniferous from the late Permian. Clay minerals, in most tonsteins, belong to the kaolinite group or are composed mainly of mixed layers of illite and smectite. The presence of quartz is significant in silicon tonsteins; the alkaline and mafic ones are enriched with anatase. The presence of pyrite in all tonsteins is due to the influence of seawater. This study belongs to the category Geochemistry & Geophysics.

Regarding the development of the study, it was observed that, despite having fewer publications, the author Shifeng Dai was the most cited in the elaboration of other studies. This shows the great value of this researcher in the area of geochemistry and geophysics, as he served as a basis for the discussion of other similar studies with the intention of exploring the research area.

Another important point was the year of publication of the authors listed in Figure 3, where most of the scientific productions are from the year 2011. Among the selected works of each author, the Geosciences Multidisciplinary category was the one with the greatest coverage, while the others were only tied, except for Energy Fuels, which did not include any of the works.

4 FINAL CONSIDERATIONS

From the methodology applied, it was possible to note the importance of scientific productions, as well as the research coming from the CAFE CAPES portal, because in it there are certain ways to carry out the research, whether it is by the list of books, list of bases, search by subject or list of journals. It is worth noting that by accessing the aforementioned portal, scientific works that, in the vast majority, have to pay to have access to scientific sources, are made available free of charge due to the partnership of the Brazilian federal



government with the main scientifically based lists. Armed with this, the work presented relevant data regarding the clay mineral illite and the range of research in which it is inserted, revealing the magnitude of scientific research in the middle of society.

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