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Mapping Ophiolite Research with an Emphasis on Naga Hills Ophiolite: Biblioshiny Analysis

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A detailed bibliometric analysis of ophiolite research from 1967 to 2023, with a focus on the Naga Hills Ophiolite, was conducted using the Web of Science (WoS) database. The study analyzed 8,736 publications globally, including 468 from India, and 27 specifically on Naga Hills Ophiolite. This study employed the bibliometrix R package (Version 4.4.0) via R Studio for analysis, with data retrieved from WoS on July 21, 2023. Results show a steady rise in publication output, reflecting growing interest in ophiolite studies. Globally, Yang J.S. emerged as the most prolific author, while Santosh M. leads in India. In Naga Hills Ophiolite research, Singh A.K. and Ao A. were key contributors. The Chinese Academy of Sciences and the Department of Science and Technology (India) were the leading institutions. China and India are the primary contributors to ophiolite research, including Naga Hills Ophiolite studies. Prominent journals include 'Lithos' globally, 'Journal of Asian Earth Sciences' in India, and 'Geological Journal' for NHO. Evolution and Geochemistry were frequently cited keywords. Although WoS was the main source, future research

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should incorporate other databases and print publications. This analysis provides valuable insights into the global and regional trends in ophiolite research, highlighting key contributors and areas for future study, particularly for the underexplored Naga Hills Ophiolite.

Keywords: Ophiolites; Naga Hills ophiolite; biblioshiny; bibliometric; web of science.

1. INTRODUCTION

Ophiolites represent sections of Earth's oceanic crust and underlying mantle that are placed onto continental margins and have been a growing research area since the 19th century [1,2]. Typically, ophiolites consist of a layered sequence of ultramafic, mafic, and sedimentary layers [3]. They are formed in various geotectonic settings, with examples found worldwide, including in the Troodos ophiolite, Oman ophiolite, Qinling-kunlun [4,5,6] (Fig. 1a). In India, ophiolites are reported along the northern and eastern edges of the Indian plate, where the Indian continental block collided with intra-oceanic island arcs within the Neotethys [7,8]. Ophiolites occurring along the northern Indian plate margin are located along the Indus-Yarlung-Tsangpo Suture Zone [9,10]. The Indo-Myanmar Range (IMR) marks the collision between the Indian and Burma microplates on the eastern margin of the Indian plate [11,12].

The Naga Hills Ophiolite (NHO), located in northeastern India, extends for approximately 200 km along the Myanmar border [13] with around 30 km situated within the Noklak district of Nagaland (Fig. 1c). Located in the eastern edge of India, Noklak is one of the newest regions that was formerly part of the Tuensang district. Noklak became an independent district on January 20, 2020. The NHO comprises diverse rock types such as pillow basalts, plagiogranites, cumulate gabbro, and serpentinized ultramafic rocks [14,15]. The mineralogical composition and geochemical signatures indicate a specific formation process, believed to have formed in SSZ or MOR setting, shaping the tectonic forces of the NHO [16,17]. This formation is critical for understanding the tectonic evolution of the region, contributing to reconstructing its paleogeography and subduction history, yet existing literature on the NHO provides a limited view of these processes. Current studies have documented isolated aspects of the NHO's petrological, geochemical and tectonic features but there is an absence of a comprehensive overview that integrates these findings into a clear picture of how the NHO has evolved. Preliminary field visits in 2021 and 2022 resulted in the collection of several rock samples, which will be utilized in future studies. A thorough understanding of the genetic relationships between various rock types within the NHO remains underexplored. The work carried out in this study offers an overview of the NHO, which has received relatively less attention compared to other major ophiolite complexes worldwide. This study undertakes a bibliometric analysis, using existing studies to identify trends and highlight areas in need of future research work.

Bibliometrics, introduced by Pritchard [18], offers a quantitative and qualitative analysis of academic literature over time. It examines publication characteristics such as authorship, sources, institutions, journals, and citation networks. Bibliometric analysis is a valuable tool for assessing current trends in academic literature within a specific field and guides future research. Recently, the use of Bibliometrix has gained significant traction across various disciplines to enhance research performance [19]. This tool focuses on three key indicators: the quantity indicator, which measures researcher productivity; the quality indicator, evaluates research impact through citation analysis; and the structural indicator, examines the relationships between publications, authors, international collaborations, and research areas. Using data from the Web of Science (WoS) database, this study analyzes publications on ophiolites at global, India, and NHO. WoS offers high quality and curated indexing from selective coverage of influential publications across various fields. A thorough longitudinal examination of research trends established for understanding the foundational and emerging areas within the field is made possible by WoS extensive multidisciplinary coverage. Additionally, WoS database integrates well with bibliometric tools such as Biblioshiny for advanced citation analysis. India and the NHO are part of global ophiolite records, with the NHO also being a subset of Indian records. The NHO is analyzed separately as the main focus of this research. Bibliometric analysis was conducted through the open-source software BibliometrixR to evaluate citation networks, co-citations, and research collaborations. The aim is to provide a

comprehensive overview of the scientific output on ophiolites from 1967 to 2023, highlighting general information, key citations, active authors, influential journals, sources, keywords, and h-index analysis. The analysis of the most commonly used terms from titles, authors and keywords will reveal valuable insights into current research trends.

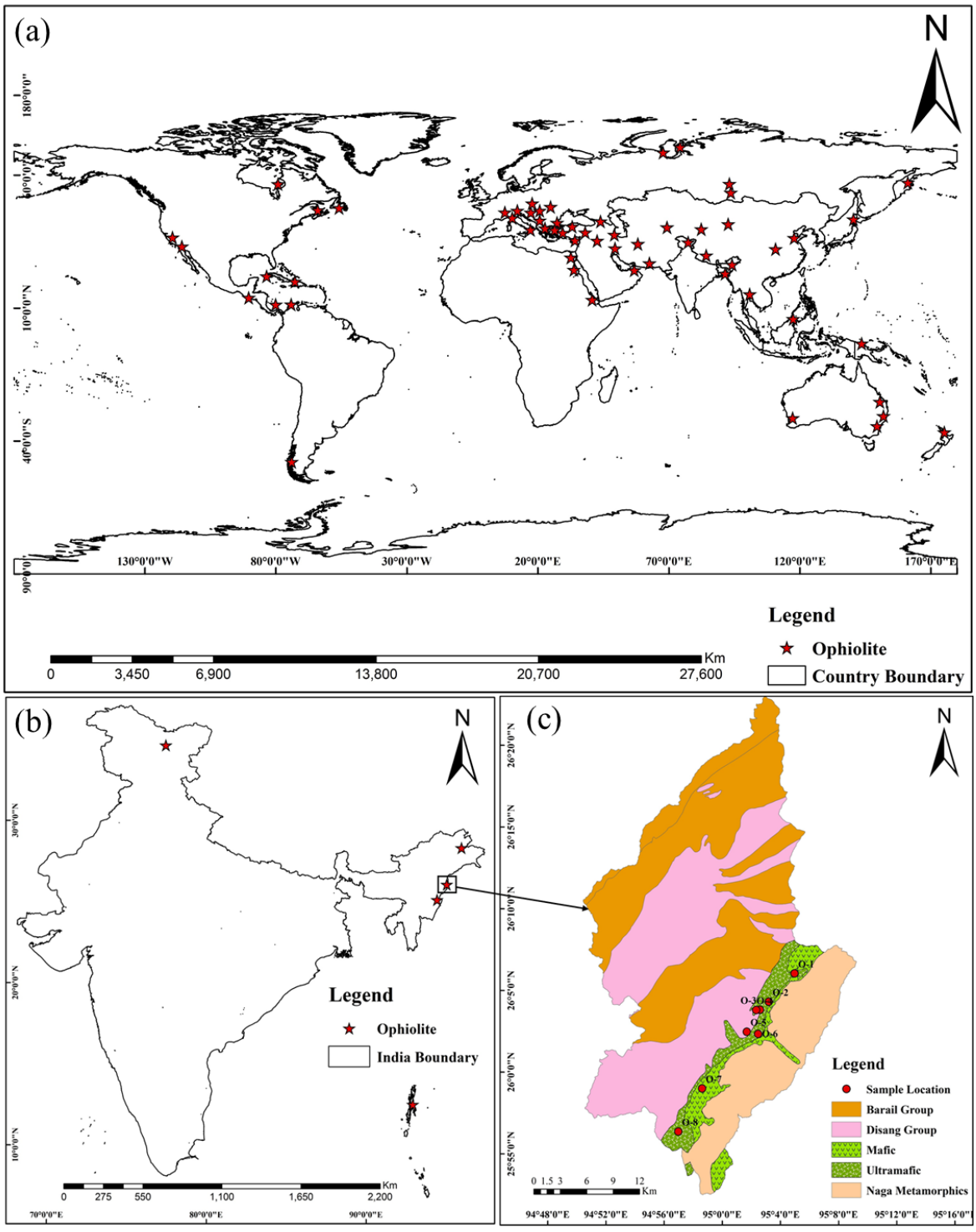

Fig. 1. Ophiolite locations (marked with red stars) (a) Global distribution of ophiolites, (Natural Earth data). (b) Distribution of ophiolites in India (Survey of India data). (c) Naga Hills Ophiolite (NHO) (after Anon, 1986)

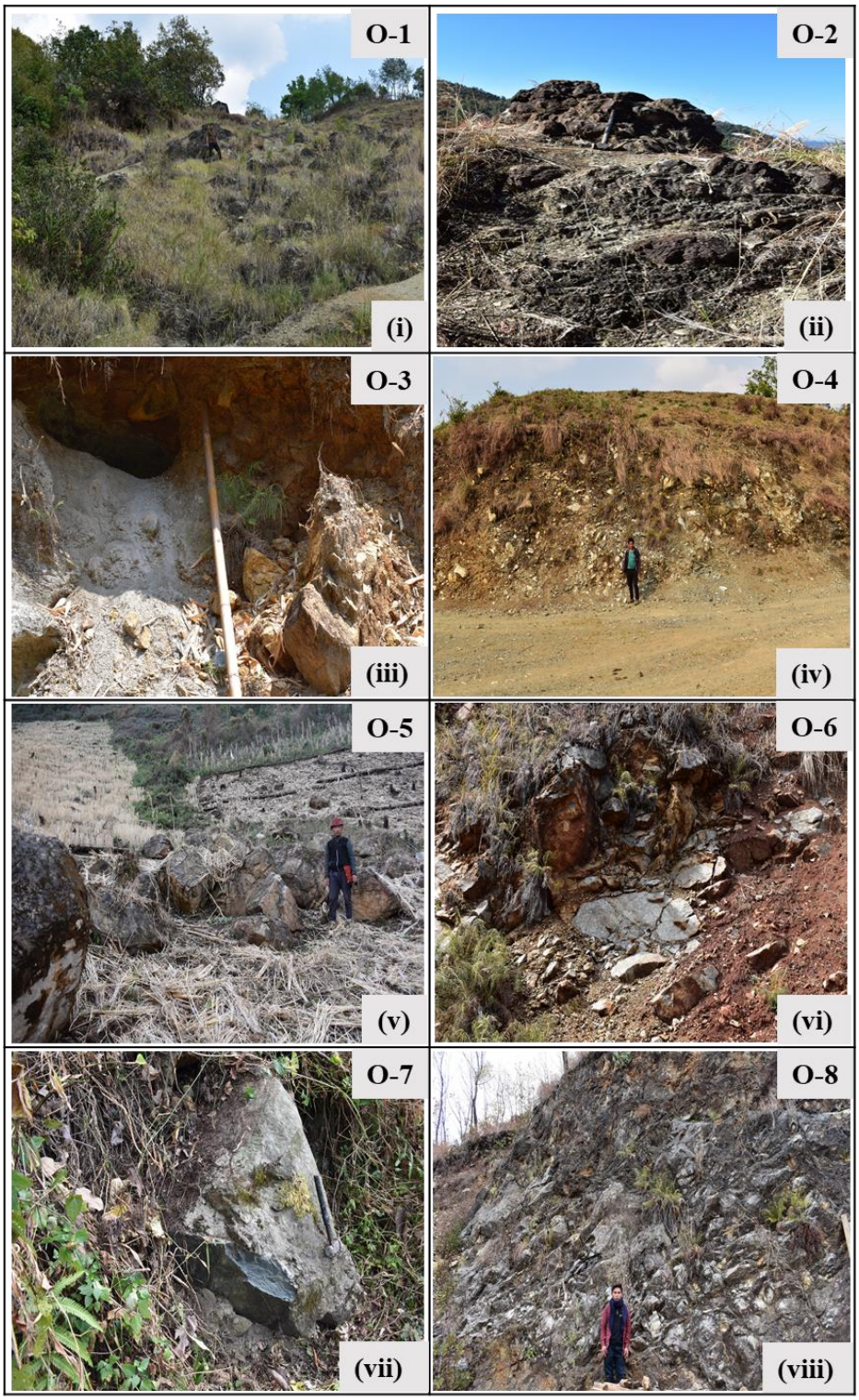

Fig. 2. Field photographs of sample locations O-1 to O-8 are shown in Fig. 1c. (i) Scattered rock samples, (ii) Serpentinized NHO rock showing signs of significant weathering, (iii) Powdered serpentinized rock on the left (beside the bamboo stick) and more compact, fresher rocks on the right, (iv) A massive outcrop of NHO rock, (v) Large, scattered rock exposures, (vi) A prominent ultramafic rock exposure surrounded by red soil and light vegetation, (vii) Rock exposure partly covered by dense vegetation, (viii) weathered outcrop of ultramafic rock

2. METHODOLOGY

In this study, a bibliometric approach was employed, and data was collected from the WoS Core Collection on July 21, 2023. The dataset was compiled using the search term “Ophiolite” yielding 8736 publications globally, 468 reports with the keywords “India ophiolite” AND "India” and 27 publications for “Naga Hills Ophiolite” AND “Naga Ophiolite”. To ensure the accuracy and relevance of the data, only academic journal publications were selected to maintain credibility. Bibliometric data were exported from WoS in BibTeX (.bib) format. The bibliometrix R package (Version 4.4.0, released on 24/04/2024) was installed and utilized via R Studio. Biblioshiny app was started by entering the command biblioshiny( ) in R console [20]. Biblioshiny was launched to conduct the bibliometric analysis by uploading the BibTeX file from WoS. Data were analyzed using Excel files generated from biblioshiny. The Excel files were screened and deduplication treatment was done by eliminating the double data and keeping only a single valid data for analysis. The time spans were 56 years (1967-2023) for global ophiolites, 37 years (1986-2023) for India ophiolites, and 12 years (2011-2023) for NHO as per available resources.

3. RESULTS AND DISCUSSION

The bibliometric analysis yielded insights into various performance metrics, including research growth, influential academic papers, country-wise analyses, institutional assessments, leading journals, the most productive and highly cited authors, and keywords in the field of ophiolite in global, India, and NHO. Table 1 shows an overview description of ophiolite research in global, India, and NHO.

3.1 Annual Chronological Growth of Publications Output

The annual increase in publications related to ophiolite research indicates a consistent upward trend in publication activity, suggesting that the research is currently experiencing steady growth. Table 2 details the chronological growth of bibliometric research over the recent decade, specifically from 2019 to 2023. According to the WoS database, the global output in the ophiolite domain has reached a total of 8,724 publications, with an average of 1.84 papers per year from 1967 to 2023. In India, the total output amounts to 465 publications, averaging 3.6 papers per year from 1986 to 2023. The NHO has seen a total of 27 publications, with an average of 2.65 papers per year from 2011 to 2023. The peak number of publications and citations globally occurred in 2020 and 1971, respectively. For India, the publication on ophiolite was highest in the year 2022, with 2009 recording the most citations, while for NHO, the peak for both publications and citations occurred in 2022 and 2019, respectively, as illustrated in Fig. 3.

Table 1. Overview of research on ophiolite globally, in India, and within the NHO, analyzed through the Biblioshiny platform

Description	Results		
	Global	India	NHO
Timespan	1967:2023	1986:2023	2011:2023
Sources (Journals, Books, etc)	459	98	12
Documents	8724	465	27
Annual Growth Rate %	8.35	6.95	0
Average citations per document	38.35	49.17	17.41
References	207765	20597	1308
Keywords Plus (ID)	11047	1493	157
Author's Keywords (DE)	13436	1273	114
Authors	15156	1260	84
Authors of single-authored documents	621	27	1
Single-authored documents	888	31	1
Co-Authors per Documents	4.27	4.67	4.7
International co-authorships %	40.46	48.82	40.74

Table 2. Chronological Growth of Ophiolite-Related Publications in the recent decade

S.N.	Years	No of publications			Mean total citation per year		
		Global	India	NHO	Global	India	NHO
1.	2023	178	12	1	0.1	0	0
2.	2022	439	42	7	0.77	0.78	1.14
3.	2021	448	37	2	1.2	1.41	3
4.	2020	467	33	1	1.9	1.94	2.2
5.	2019	404	32	2	2.4	3.01	5.08
6.	2018	390	21	2	2.65	3.79	3.07
7.	2017	337	33	4	2.66	2.71	1.31
8.	2016	363	20	1	3.24	7.59	3.33
9.	2015	360	30	2	3.16	2.76	1.95
10.	2014	324	23	3	2.65	3.25	2.64

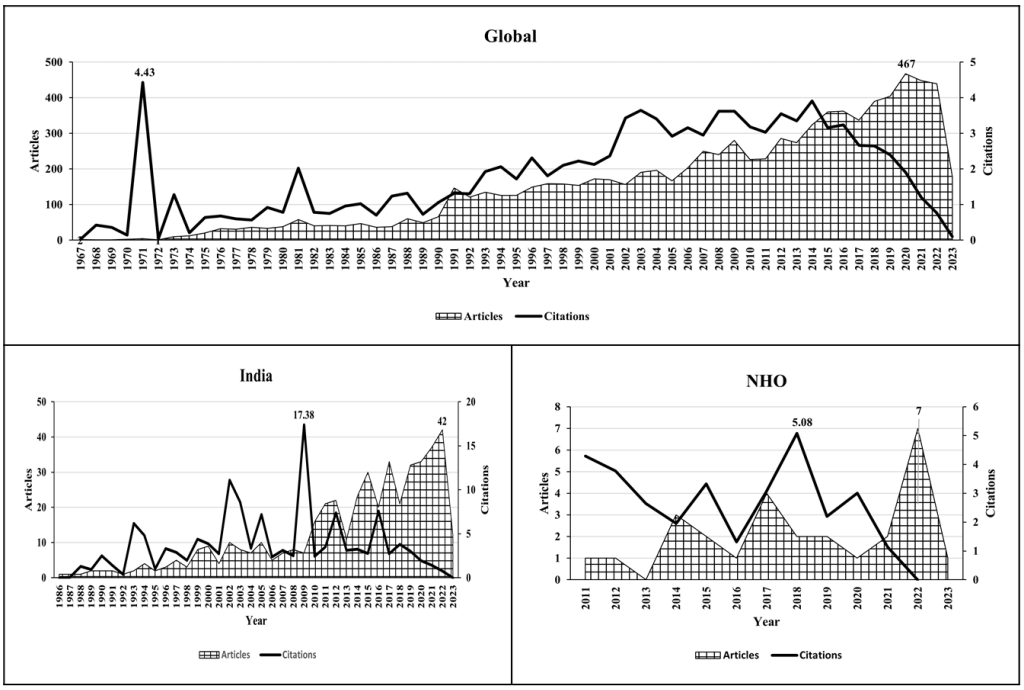

Fig. 3. Yearly publication trends for ophiolite studies in global, India, and NHO, highlighting peaks in both articles and citations over time

3.2 Analysis of High-Citation Articles

The analysis of high-citation articles reveals key contributions to ophiolite research globally from 1967 to 2023. The article titled "Geochemical fingerprinting of oceanic basalts with applications to ophiolite classification and the search for Archean oceanic crust" stands out as the most cited. This study identifies two geochemical proxies: Th-Nb for crustal input and Ti-Yb for mantle melting depth, essential for classifying basalts and understanding their tectonic settings. The article titled "Cenozoic geological and plate tectonic evolution of SE Asia and the SW Pacific: computer-based reconstructions, model and animations" is recognized as the most cited work for ophiolite in India from 1986 to 2023. By employing advanced modeling, the study visualizes tectonic plate shifts over millions of years, illuminating the region's geological history. Another key contribution, "Upper Jurassic radiolarians from the Naga ophiolite, Nagaland, northeast India" emerged as the highest-cited article for the period of 2011 to 2023 in regards to NHO, presents well-preserved Upper Jurassic radiolarians found in chert samples, providing aids in reconstructing past oceanic and continental configurations during the Jurassic period.

Table 3. Highest citation articles on ophiolite research in global, India, and NHO contexts

S.N.		Articles	Citations
1.	Global	Pearce, J. A. (2008). Geochemical fingerprinting of oceanic basalts with applications to ophiolite classification and the search for Archean oceanic crust. *Lithos*, *100*(1-4). [21]	2276
2.		Hall, R. (2002). Cenozoic geological and plate tectonic evolution of SE Asia and the SW Pacific: computer-based reconstructions, model and animations. *Journal of Asian earth sciences*, *20*(4). [22]	1867
3.		Xiao, W., Windley, B. F., Hao, J., & Zhai, M. (2003). Accretion leading to collision and the Permian Solonker suture, Inner Mongolia, China: Termination of the central Asian orogenic belt. *Tectonics*, *22*(6). [23]	1727
4.		Christensen, N. I. (1996). Poisson's ratio and crustal seismology. *Journal of Geophysical Research: Solid Earth*, *101*(B2). [24]	1257
5.		Alavi, M. (1994). Tectonics of the Zagros orogenic belt of Iran: new data and interpretations. *Tectonophysics*, *229*(3-4). [25]	1202
6.	India	Hall, R. (2002). Cenozoic geological and plate tectonic evolution of SE Asia and the SW Pacific: computer-based reconstructions, model and animations. *Journal of Asian earth sciences*, *20*(4). [22]	1868
7.		Ji, W. Q., Wu, F. Y., Chung, S. L., Li, J. X., & Liu, C. Z. (2009). Zircon U–Pb geochronology and Hf isotopic constraints on petrogenesis of the Gangdese batholith, southern Tibet. *Chemical Geology*, *262*(3-4). [26]	799
8.		Ratschbacher, L., Hacker, B. R., Calvert, A., Webb, L. E., Grimmer, J. C., McWilliams, M. O., ... & Hu, J. (2003). Tectonics of the Qinling (Central China): tectonostratigraphy, geochronology, and deformation history. *Tectonophysics*, *366*(1-2). [27]	771
9.		Pan, G., Wang, L., Li, R., Yuan, S., Ji, W., Yin, F., ... & Wang, B. (2012). Tectonic evolution of the Qinghai-Tibet plateau. *Journal of Asian Earth Sciences*, *53*. [28]	577
10.		Ding, L., Kapp, P., & Wan, X. (2005). Paleocene–Eocene record of ophiolite obduction and initial India-Asia collision, south central Tibet. *Tectonics*, *24*(3). [29]	561
11.	NHO	Baxter, A. T., Aitchison, J. C., Zyabrev, S. V., & Ali, J. R. (2011). Upper Jurassic radiolarians from the Naga ophiolite, Nagaland, northeast India. *Gondwana Research*, *20*(2-3). [30]	60
12.		Ningthoujam, P. S., Dubey, C. S., Guillot, S., Fagion, A. S., & Shukla, D. P. (2012). Origin and serpentinization of ultramafic rocks of Manipur Ophiolite Complex in the Indo-Myanmar subduction zone, Northeast India. *Journal of Asian Earth Sciences*, *50*. [31]	49
13.		Aitchison, J. C., Ao, A., Bhowmik, S., Clarke, G. L., Ireland, T. R., Kachovich, S., ... & Zhou, R. (2019). Tectonic evolution of the western margin of the Burma microplate based on new fossil and radiometric age constraints. *Tectonics*, *38*(5). [32]	47
14.		Ao, A., & Bhowmik, S. K. (2014). Cold subduction of the Neotethys: the metamorphic record from finely banded lawsonite and epidote blueschists and associated metabasalts of the Nagaland Ophiolite Complex, India. *Journal of Metamorphic Geology*, *32*(8). [33]	45
15.		Imchen, W., Thong, G. T., & Pongen, T. (2014). Provenance, tectonic setting and age of the sediments of the Upper Disang Formation in the Phek District, Nagaland. *Journal of Asian Earth Sciences*, *88*. [34]	39

3.3 Top Countries in Ophiolite Research

From the WoS database, the most productive countries based on the number of publications, total citations, and average article citations extracted are presented in Table 4. China leads the list with a remarkable 4,426 publications globally. Fig. 4 illustrates the research outputs by

country in this field. India ranks first in publishing articles related to bibliometric studies on ophiolite in India, with a total of 413 publications, including 52 specifically referencing the NHO. However, on a global scale, India holds the 12th position. The United States has the highest number of citations globally, totaling 66,085, while China has 6,342 citations for India and 363 India citations concerning NHO (Table 4). It is important to note that the ranking based on average article citations does not align with the total citations presented in Table 4. The USA, UK, and Australia have the highest average article citations for global, India, and NHO, respectively, indicating that the quality of articles from these countries is notably superior.

3.4 Top Institutions in Ophiolite Research

The leading institutions based on the number of publications affiliated with countries in the field of ophiolite research are represented in Table 5. A total of 2,084, 429, and 53 institutions were identified for global, India, and NHO, respectively. The majority of the articles produced were affiliations to China (Global) and India (India and NHO). The Chinese Academy of Sciences stands out as the highest publisher of ophiolite studies at both global and national levels, while the Department of Science and Technology (India) contributed 12 publications related to NHO studies.

3.5 Predominant Sources for Ophiolite Research

The leading sources of publications ranked by the number of papers produced, highlighting those preferred by researchers in ophiolite research, are presented in Table 6. The journal 'Lithos' emerges as the most preferred global publication source, with 490 articles published from 1978 to 2023. In India, the 'Journal of Asian Earth Science' is the top source, featuring 44 articles published between 2000 and 2023. For NHO, the 'Geological Journal' is the predominant source, with 8 publications from 2017 to 2023, as depicted in Fig. 5. In terms of citations, 'Lithos' {Impact Factor (IF) = 3.5} have gathered a total of 21,594 citations across Global scale, 'Journal of Asian Earth Science' (IF = 3) (3,711-India), and 'Geological Journal' (IF = 1.8) (67-NHO). Notably, journals like 'Earth Science Review' (IF = 12.1) and 'Gondwana Research' (IF = 6.1) have higher impact factors but lower total citations due to fewer publications; this illustrates the challenge of publishing in high-impact journals. The h-index quantifies a researcher's productivity and citation impact [35], based on this the serves as a predictor for future research trends. The results indicate that 'Earth and Planetary Science Letters', 'Journal of Asian Earth Sciences', and 'Geological Journal' are the most active journals, exhibiting a relatively high citation rate suggesting active journals and likely to continue this trend in the future.

3.6 Author Analysis

Table 7 showcases the top authors who have contributed to the research of ophiolites, with the most significant articles that have gathered significant citations. For each article, the total citation count and average citations per year are provided. Although the table lists only one relevant author per article, many of the papers have multiple authors. The listed author may either be the first or a contributing co-author. The analysis of publication output reveals the authors with the most significant contributions to ophiolite research on global, India, and NHO. Fig. 6 illustrates the publication output of these authors, highlighting both the total number of articles published and the citations associated with each work. In terms of publication number, Yang, J. S. emerges as a leading global author in Bibliometrics research on ophiolites with 169 articles globally, while Santosh, M. with 22 articles represents India as a prominent contributor. Notably, Singh, A. K. and Ao, A. have also made significant contributions with 7 articles each about NHO. Regarding citation counts, Xiao, W. J. leads with 1,727 citations globally, Ding, L. with 561 for India, and Aitchison, J. C. with 60 citations specific to NHO studies (Table 7). Singh, A. K. and Khogenkumar, S., both affiliated with the NHO research, are credited with the same article that has received the highest citation count. Despite being listed separately as authors, they contributed to the same publication, underscoring the collaborative nature of their work within the NHO research community. It is important to note that Dilek, Y. (global), Santosh, M. (India), and Singh, A. K. and Ao, A. (NHO) are recognized as the most active authors in ophiolite research, laying the groundwork for many ongoing major research projects (Fig. 6).

Table 4. Top Country-wise research output on ophiolite in Global, India, and NHO research

No.	Country	Global			India			NHO		
		Frequency	TC	AAC	Frequency	TC	AAC	Frequency	TC	AAC
1.	China	4426	59684	38.7	293	6342	68.9	4	0	0
2.	USA	2839	66085	60	100	2701	96.5	1	0	0
3.	France	1542	27474	51.3	54	477	43.4	1	0	0
4.	UK	1326	27351	55.1	65	3926	218.1	2	0	0
5.	Japan	1148	11458	34	74	963	74.1	2	0	0
6.	Germany	1026	15711	52.7	35	1229	204.8	3	0	0
7.	Italy	1022	11878	31	14	203	101.5	0	0	0
8.	Canada	989	14696	39	33	758	68.9	0	0	0
9.	Russia	908	6218	15.5	7	3	1.5	1	0	0
10.	Australia	810	11949	51.7	57	658	47	7	107	53.5
11.	Turkey	601	8335	31.1	2	6	6	0	0	0
12.	India	555	4935	17.7	413	3724	17.3	52	363	14.5
13.	Switzerland	392	5399	40.6	22	196	32.7	0	0	0
14.	Pakistan	131	371	13.2	39	51	10.2	0	0	0
15.	Mongolia	45	328	109.3	1	0	0	1	0	0

**TC-Total Citations, *AAC-Average Article Citations*

Table 5. Most active institutions in ophiolite research globally, India and NHO

No.	Institution	Articles		
		Global	India	NHO
1.	Chinese Academy of Sciences	1062	100	0
2.	Centre National De La Recherche Scientifique (CNRS)	816	38	1
3.	Russian Academy of Sciences	662	6	1
4.	China University of Geosciences	653	46	0
5.	Udice-French Research Universities	527	34	1
6.	Chinese Academy of Geological Sciences	474	26	1
7.	Institute Of Geology and Geophysics, CAS	341	25	0
8.	Council of Scientific and Industrial Research (CSIR) - India	70	51	6
9.	Department Of Science and Technology (India)	56	46	12
10.	CSIR - National Geophysical Research Institute (NGRI)	55	44	3
11.	Geological Survey India	53	29	3
12.	Wadia Institute of Himalayan Geology (WIHG)	48	42	11
13.	Indian Institute of Technology System (IIT System)	44	36	7
14.	Banaras Hindu University (BHU)	19	14	3
15.	Indian Institute of Technology (IIT) - Kharagpur	12	12	6

Table 6. Most active sources in ophiolite research globally, India, and NHO

No	Journal	Global			India			NHO			IF (2023)
		A	TC	h-index	A	TC	h-index	A	TC	h-index	
1.	Lithos	490	21594	73	21	660	13	2	25	2	3.5
2.	Tectonophysics	326	20460	76	17	1892	15	0	0	0	2.9
3.	Earth and Planetary Science Letters	279	18967	80	11	1415	11	0	0	0	5.3
4.	Acta Petrologica Sinica	272	7196	45	13	309	4	0	0	0	1.8
5.	Journal of Asian Earth Sciences	272	16089	59	44	3711	24	3	106	3	3
6.	Journal of Geophysical Research-Solid Earth	226	10815	58	3	432	3	0	0	0	3.9
7.	Gondwana Research	211	14161	69	24	1992	19	1	60	1	6.1
8.	Geology	187	10305	59	1	32	1	0	0		5.8
9.	Tectonics	161	9691	53	12	1557	11	1	47	1	4.2
10.	Geological Journal	118	1574	22	28	228	8	8	67	4	1.8
11.	Journal of Metamorphic Geology	82	4284	41	3	128	3	2	75	2	3.4
12.	Earth-Science Reviews	70	7862	42	13	1454	12	0	0	0	12.1
13.	Journal of the Geological Society of India	41	352	10	20	233	8	0	0	0	1.3
14.	Current Science	28	206	8	17	93	5	5	21	3	1
15.	Episodes	25	676	14	5	108	4	1	30	1	3.1

**A-Articles, *TC-Total Citations, *IF-Impact Factor*

Table 7. Authors with the highest number of publications on ophiolite research globally, India, and NHO

No.		Author	PT	TC	TCperY	PY	NA
1.	Global	Yang, J. S.	Ophiolites of the Kunlun Mountains, China and their Tectonic Implications. (1996) [36]	309	10.66	1989-2023	169
2.		Arai, S.	Podiform Chromitites of the Tari-Misaka Ultramafic Complex, Southwestern Japan, as Mantle Melt Interaction Products. (1994) [37]	268	8.65	1991-2023	132
3.		Dilek, Y.	Ophiolite Genesis and Global Tectonics: Geochemical and Tectonic Fingerprinting of Ancient Oceanic Lithosphere. (2011) [38]	847	60.50	1990-2023	97
4.		Robinson, P. T.	Podiform Chromitites in the Luobusa Ophiolite (Southern Tibet): Implications for Melt-Rock Interaction and Chromite Segregation in the Upper Mantle. (1996) [39]	477	16.45	1982-2023	78
5.		Xiao, W. J.	Accretion Leading to Collision and the Permian Solonker Suture, Inner Mongolia, China: Termination of the Central Asian Orogenic Belt. (2003) [23]	1727	78.50	2002-2023	76
6.	India	Santosh, M.	Anatomy of a Cambrian Suture in Gondwana: Pacific-Type Orogeny in Southern India? (2009) [40]	389	24.3	2009-2020	22
7.		Singh, A. K.	Petrology and Geochemistry of Abyssal Peridotites from the Manipur Ophiolite Complex, Indo-Myanmar Orogenic Belt, Northeast India: Implication for Melt Generation in Mid-Oceanic Ridge Environment. (2013) [41]	56	4.7	2008-2023	21
8.		Ghosh, B.	Significance of Chromian Spinels from the Mantle Sequence of the Andaman Ophiolite, India: Paleogeodynamic Implications. (2013) [42]	40	3.3	2007-2022	20
9.		Aitchison, J. C.	Remnants of a Cretaceous Intra-Oceanic Subduction System within the Yarlung-Zangbo Suture (Southern Tibet). (2000) [43]	339	13.6	2000-2023	18
10.		Ding, L.	Paleocene-Eocene Record of Ophiolite Obduction and Initial India-Asia Collision, South Central Tibet. (2005) [29]	561	28.0	2003-2023	14
11.	NHO	Singh, A. K.	Genesis and Tectonic Implications of Cumulate Pyroxenites and Tectonite Peridotites from the Nagaland-Manipur Ophiolites, Northeast India: Constraints from Mineralogical and Geochemical Characteristics. (2017) [44]	24	3	2017-2022	7
12.		Ao, A.	Tectonic Evolution of the Western Margin of the Burma Microplate Based on New Fossil and Radiometric Age Constraints. (2019) [32]	47	7.83	2014-2022	7
13.		Bhowmik, S. K.	Cold Subduction of the Neotethys: The Metamorphic Record from Finely Banded Lawsonite and Epidote Blueschists and Associated Metabasalts of the Nagaland Ophiolite Complex, India. (2014) [33]	45	4.09	2014-2022	5

No.	Author	PT	TC	TCperY	PY	NA
14.	Khogenkumar, S.	Genesis and Tectonic Implications of Cumulate Pyroxenites and Tectonite Peridotites from the Nagaland-Manipur Ophiolites, Northeast India: Constraints from Mineralogical and Geochemical Characteristics. (2017) [44]	24	3	2017-2022	4
15.	Aitchison, J. C.	Upper Jurassic Radiolarians from the Naga Ophiolite, Nagaland, Northeast India. (2011) [30]	60	4.29	2011-2019	3

**PT-Publication Title, *TC-Total Citations, *TCperY-Total Citation per Year, *PY-Publication Year, *NA-Number of Articles*

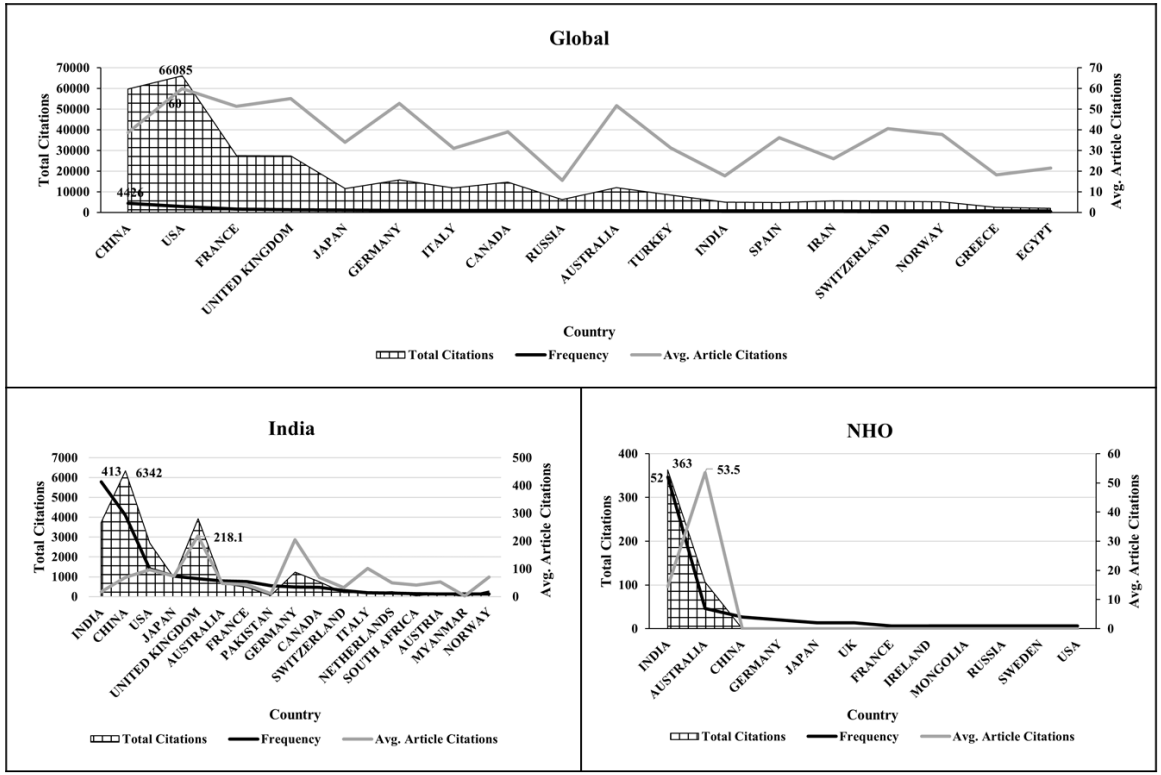

Fig. 4. Country-wise Publication of Ophiolite in Global, India, and NHO, displaying total citations, article frequency, and average article citation values

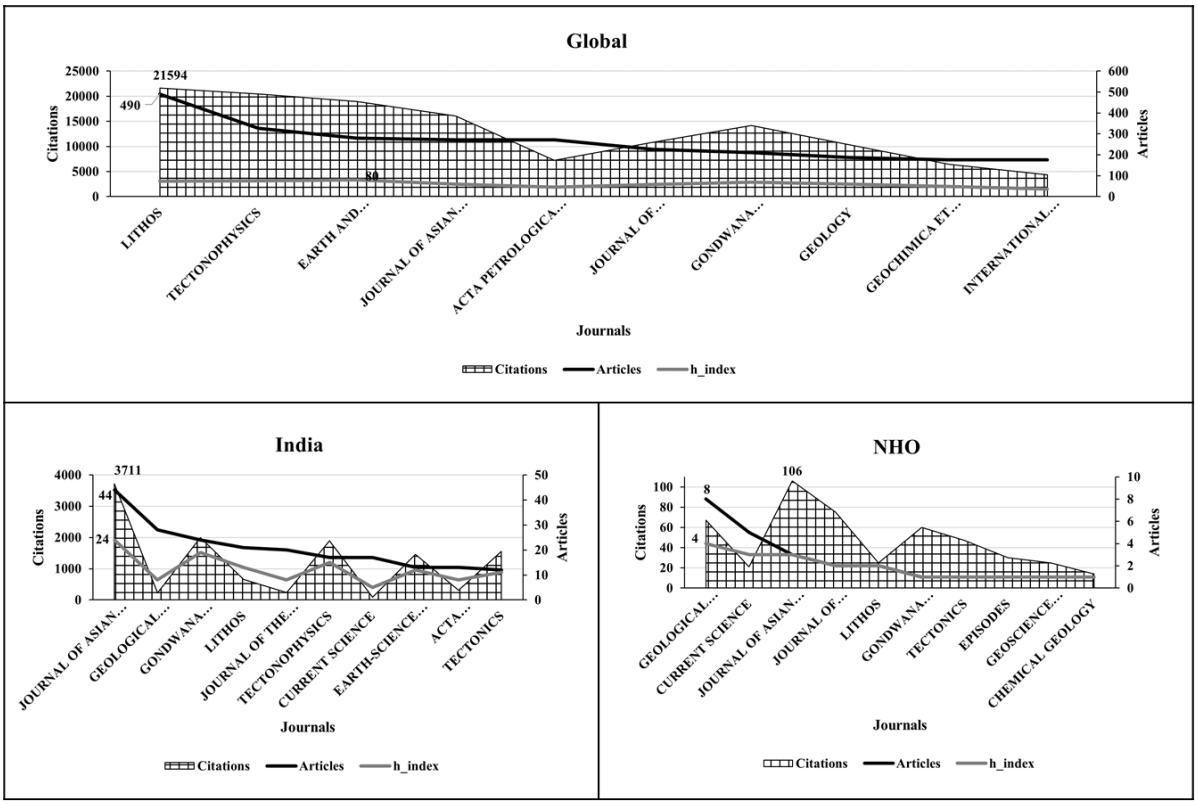

Fig. 5. Journal-wise publication of research on ophiolite in Global, India, and NHO, showing the highest values for articles, citations, and h-index

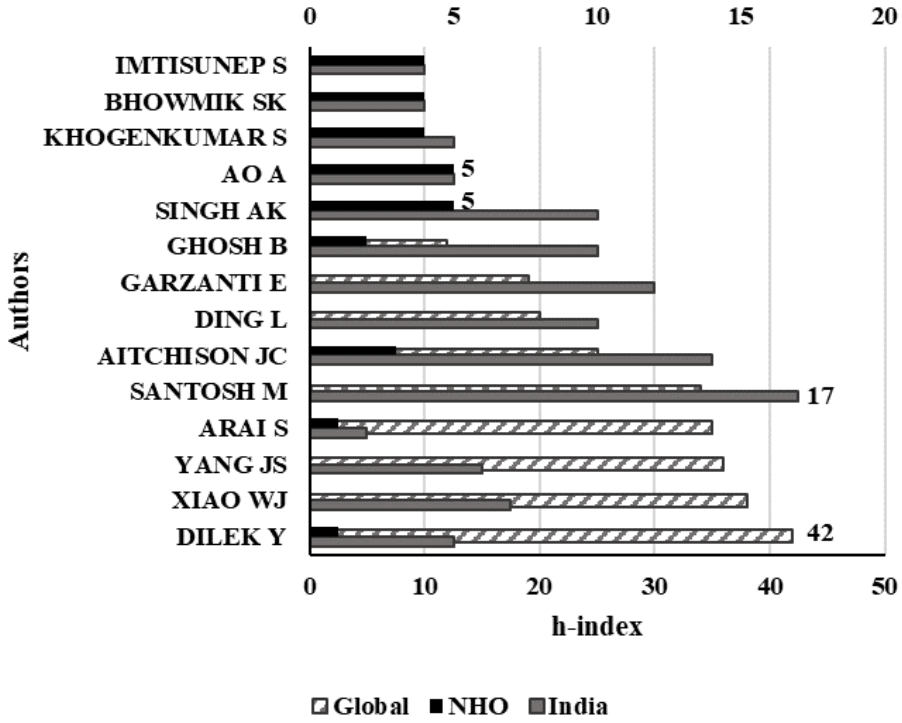

Fig. 6. Prominent authors from ophiolite in Global, India and NHO highlighting h-index

Table 8. Most relevant keywords on ophiolite in global, India, and NHO research

No.	Words	Articles		
		Global	India	NHO
1.	Evolution	1285	79	3
2.	Ophiolite	934	45	1
3.	Geochemistry	874	51	9
4.	Origin	704	31	2
5.	Tectonic Evolution	692	64	0
6.	Rocks	655	33	2
7.	Constraints	523	43	6
8.	Complex	485	26	6
9.	Zircon U-Pb	184	52	4
10.	India-Asia Collision	46	46	0
11.	Myanmar Orogenic Belt	19	16	8
12.	Chromian Spinel	229	25	7
13.	Midocean Ridge	134	13	7
14.	Abyssal Peridotites	1	16	6
15.	Subduction	386	27	6

3.7 Keyword Analysis

The most prominent keywords utilized by authors in Bibliometrics research on ophiolite showcase an interconnected network of common terms indexed in the WoS. A total of 11,047 keywords were analyzed in papers published on ophiolites globally, with “evolution” being the most frequently occurring term since 1990, followed by “ophiolite” (1990) and “geochemistry” (1981). In the context of ophiolite in India, 1,193 keywords were analyzed, revealing “evolution” as the leading term occurring from 1993, followed by “tectonic evolution” (1994) and “zircon U-Pb” (2010). For NHO, 157 keywords were examined, showing “geochemistry” as the most common term since 2011, along with “Myanmar orogenic belt” (2017) and “chromian spinel” (2012). These keywords align with the search terms used in our study. The term “evolution” reflects essential information about geological processes related to the formation, alteration, and emplacement of oceanic crust, offering broader insights into Earth’s tectonic and geodynamic history. Meanwhile, “geochemistry” enhances our understanding of the complex interactions among mantle processes, magma generation, and crustal formation. Other significant keywords such as “origin,” “tectonic evolution,” “oceanic crust,” “subduction,” and “mantle” highlight the main applications of ophiolite research.

4. CONCLUSION

This study integrates bibliometric analysis using Bibliometrix with network visualizations to map the current landscape of ophiolite research. The study identifies the active research areas that identify where the focus lies in the ophiolites, guiding future research trends and helping in understanding which aspects to currently prioritize. Since the field’s inception in 1967, there has been a steady increase in annual publication output, with bibliometric analysis revealing structural developments. The analysis utilized the widely recognized WoS database, which indexed a total of 8,724 publications globally, along with 465 from India and 27 from the Naga Hills Ophiolite region. Based on the h-index, two groups of authors and sources sharing equal values were identified. Evaluating bibliometric parameters Yang, J.S. was found to be the most prolific author worldwide, while Santosh, M. leads in India. Singh, A.K. and Ao, A. are notable contributors from NHO. Dilek, Y. (global), Santosh, M. (India), Singh, A.K., and Ao, A. (NHO) are recognized as prominent researchers who have significantly influenced current major projects in the field. The most active journals, characterized by high citation rates, include ‘Earth and Planetary Science Letters’, ‘Journal of Asian Earth Sciences’, and ‘Geological Journal’. ‘Lithos’ ranks as the most productive journal globally, while ‘Journal of Asian Earth Sciences’ is prominent in India, and ‘Geological Journal’ leads for NHO publications. Findings indicate that “Evolution” and “Geochemistry” are the most active subject areas in bibliometric research. China and India stand out as leaders in ophiolite and NHO research, with the Chinese Academy of Sciences and Department of Science and Technology (India) producing the highest number of publications.

The available studies cover various aspects, including the origin and serpentinization of ultramafic rocks, tectonic evolution and the geochemical characteristics of the NHO rocks. However, many of these works are isolated and do not provide an integrated framework to connect the findings across different studies. For instance, while some articles explore the metamorphic history and petrogenesis of the NHO, they lack comprehensive discussions on how these processes interrelate within the broader geological context. Understanding the context not only enhances the discussion about NHO but also lays the groundwork for future research. This can help address gaps in knowledge and look into topics that haven't received much attention in the current studies. NHO research has witnessed general trends since 2011, with 27 valid publications recorded up to July 21, 2023. The findings emphasize the growing academic interest in the NHO, which is critical for fostering further exploration and investigation. The study reveals that research on NHO has been published across 12 sources, with the 'Geological Journal' leading in publication volume, and the 'Journal of Asian Earth Sciences' being the most cited source. Most publications are authored by Indian scholars affiliated with institutions like the Department of Science and Technology (India) and Wadia Institute of Himalayan Geology (WIHG). The most prominent authors contributing high-quality papers include Singh, A.K. (2017-2022), Ao, A. (2014-2021), and Bhowmik, S.K. (2014-2022). Although this study primarily focuses on the WoS database for bibliometric analysis, other sources, including print publications, should be considered for future research endeavors. A notable limitation of this study is that while publication numbers indicate quantity, citation counts do not necessarily reflect the quality of the research.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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