Decadal (2013–2022) Bibliometric Analysis and Visualization of the Journal of Geological Society of India and Insights into Post-Covid Publication Behaviour

Renjith V R [1,*], Prasanth R S [2], Rajesh S [3], Pradeepkumar A P [4]

[1] *Kerala University Library, University of Kerala, Thiruvananthapuram 695 034, India*
[2] *School of Environmental Sciences, Mahatma Gandhi University, Kottayam, Kerala, India*
[3] *Department of Earth Sciences, Kerala University of Fisheries and Ocean Sciences, Panangad, Kochi, Kerala, India*
[4] *Department of Geology, University of Kerala, Thiruvananthapuram 695 581, Kerala, India*

ABSTRACT

This study on bibliometrics investigates the patterns of publication in the Journal of Geological Society of India (JGSI) from 2013 to 2022, spotlighting significant fluctuations and a robust recovery post-Covid pandemic, which led to an unprecedented number of publications in 2022. This research emphasizes the considerable influence of JGSI in geology, demonstrated by highly cited articles and the notable involvement of the major Indian geological organizations such as GSI, NGRI, WIHG, AMD, BHU etc. Nonetheless, the findings point to a regional focus of contributions mainly from India, suggesting a lack of broader international collaboration. The study also highlights a persistent gender imbalance, with a lower representation of women authors, despite an increase in female geology postgraduates in India. JGSI's restricted access and relatively low impact factor could be discouraging submissions from distinguished geologists, thereby affecting its citation metrics. A detailed analysis of the most cited papers reveals a primary concentration on groundwater, landslides, and stratigraphy, consistent with the patterns observed in keyword co-occurrence studies. Moreover, co-citation network analysis illustrates JGSI's connections with essential geoscience resources, strengthening its role in promoting fundamental geological research in India and its participation in the international geological research community.

1. INTRODUCTION

Bibliometric techniques serve as an effective tool for analyzing research landscapes across diverse scientific subject fields (Sinha, 2012; Fu et al., 2012). Commonly employed methods in such bibliometric investigations encompass the examination of publication outputs within specific research domains, scrutiny of subject-specific journals, identification of influential authors, countries of origin, research institutions, and the extraction of frequently occurring keywords (Liu et al., 2012). The application of Bibliometric Network Analysis Techniques further facilitates the elucidation of relationships among keywords, countries, research institutes, and authors, encompassing analytical approaches such as co-word analysis, co-citation analysis, and co-authorship analysis.

The *Journal of Geological Society of India (JGSI)* (https://pubs.geoscienceworld.org/jour-geosocindia), published by Springer on behalf of the Geological Society of India, is devoted

to the Geological Sciences and associated disciplines. As the official publication of the esteemed Geological Society of India, *JGSI* holds a prominent position as a premier Indian journal within the field of Geology. Functioning as an invaluable platform, *JGSI* enables the dissemination of scientific findings, theories, methodologies, and advancements within the realm of Geological Sciences. Encompassing a wide spectrum of geological topics, including petrology, mineralogy, structural geology, sedimentology, stratigraphy, tectonics, geochemistry, geophysics, paleontology, environmental geology, and geological hazards, *JGSI* is committed to fostering the exchange of knowledge and ideas among researchers, academicians, and professionals. Through these endeavors, the journal significantly contributes to the collective understanding of Earth's intricate processes and its evolutionary history. Remarkably, *JGSI* has not been subjected to systematic bibliometric scrutiny in the past with the recent exception of Maraddi et al. (2023). Consequently, recognizing the pressing need for a comprehensive bibliometric evaluation of the journal which also scrutinizes the content more efficiently, this study was undertaken.

2. LITERATURE REVIEW

Álvarez García et al. (2023) conducted a comprehensive examination of the evolution of the *Spanish Journal of Finance and Accounting*, spanning from its inception to the present. Their primary objective was to discern the journal's trajectory by scrutinizing published articles, authorship patterns, prolific institutions and nations, research themes, as well as citation dynamics, including the most frequently cited papers and the typology of citing articles. Utilizing bibliometric indicators, the analysis relied on data extracted from the Scopus database. In similar vein, Lrhoul et al. (2023) meticulously analyzed the bibliographic data pertaining to the *Moroccan Journal of Chemistry* during the years 2013 to 2021. This open-access research journal, with a specialized thematic scope and global online visibility, was scrutinized using data sourced from WoS Core Collections spanning 2014 to 2021. Employing Gephi, a tool renowned for large-scale data visualization, scientometric networks were constructed to unveil publication patterns. The investigation unveiled noteworthy alignment between the research themes prevalent in the *Moroccan Journal of Chemistry* and the primary research domains

within Moroccan chemical scholarly output. These notably included *Multidisciplinary Chemistry, Physical Chemistry, and Analytical Chemistry*. Moreover, the analysis identified the journal's pivotal role as a catalyst for fostering novel traditions of research collaboration between Moroccan institutions and target nations, notably within Asia and Africa. Additionally, it elucidated the *Moroccan Journal of Chemistry*'s significance as a platform for prolific chemical researchers in Morocco to disseminate preliminary research findings and engage in discourse regarding contemporary themes.

In a separate study, Kumar et al. (2023) turned their focus to *F1000Research*, a distinguished journal in the Q1 category known for its interdisciplinary coverage. Employing VOSviewer and Biblioshiny via R-studio interface, bibliometric analysis was conducted to unravel the journal's trajectory since its inception in 2012, encompassing a total of 5767 articles up to the end of 2022. Various analyses were deployed, encompassing publication and citation trends, influential authors, institutions, nations of prominence, frequently employed keywords, bibliographic connections among authors, countries, and documents, emerging research themes, and trending keywords. The findings underscored the United States' predominant contribution and identified "COVID-19" as a recurrent keyword of significance. Furthermore, Vaishya et al. (2023) embarked on an exploration of the contemporary research trends showcased within the *International Orthopaedics* journal, deploying bibliometric analysis. Using data drawn from the Scopus database, a meticulous analysis was conducted on articles published in the *International Orthopaedics* journal spanning from 1977 to 2022. Key stakeholders, including nations, institutions, and authors, were identified, with their collaborative associations scrutinized through MS Excel and VOSviewer software. This analysis revealed a total of 7645 papers originating from 107 countries, notably 40 from Europe and 32 from Asia. Mohapatra and Sahoo (2022) conducted a scientometric analysis encompassing 4347 papers featured in the journal *Scientometrics* during the period from 2000 to 2019. The study delved into various facets of *Scientometrics*, encompassing document types, the temporal distribution of published papers, contributors and their levels of productivity, geographical origins, and citation patterns. The analysis revealed that the year 2019 witnessed the lowest number of citations,

totaling 797 (0.85%). Notably, China emerged as the predominant contributor, representing 11.74% of the contributions, followed closely by the United States at 10.57%.

3. OBJECTIVES

The specific objectives of the study are:

- To determine the number of papers published in *JGSI* from 2013 to 2022

- To determine the top highly cited papers of *JGSI* published during the period 2013 to 2022

- To determine the most productive authors, institutions, and countries

- To determine the keywords clustering of *JGSI* papers published during the period.

- To determine the cited sources in *JGSI* papers published during the period.

- To identify the cited authors in *JGSI* papers published during the period.

4. METHODOLOGY

This study adopts a bibliometric approach to analyze a specific scientific journal within the domain of Geology. Such bibliometric assessments have been previously employed in the scholarly community, exemplified by studies on journals like the *Journal of Documentation* (Mokhtari et al., 2021), the *Indian Journal of Dermatology, Venereology and Leprology* (Ligade, 2022), and the *International Journal of Intercultural Relations* (Badola and Agrawal, 2023).

To acquire the requisite dataset, a refined search was executed on July 7, 2023, within the Web of Science (WoS) database. The search query employed was as follows:

$$SO = (JOURNAL\ OF\ THE\ GEOLOGICAL\ SOCIETY\ OF\ INDIA)$$

The bibliographic records of articles published during the timeframe from 2013 to 2022 were subsequently retrieved and saved as a tab-delimited file. The analysis and visualization of this data were conducted employing Microsoft Excel and the VOSviewer software developed by Van Eck and Waltman (2010). We have

Table 1. Year-wise distribution of papers published in *JGSI* during the period 2013-2022.

Year	No. of papers	%
2013	150	9.53
2014	136	8.64
2015	143	9.08
2016	143	9.08
2017	177	11.25
2018	183	11.63
2019	155	9.85
2020	123	7.81
2021	163	10.35
2022	201	12.78
Total	**1574**	**100**

used ChatGPT-4 in order to improve language, in the preparation of this paper. The content has been edited and reviewed by us.

5. ANALYSIS AND INTERPRETATION

5.1. Year-wise Distribution of Published Papers in *JGSI* during 2013 – 2022

There are 1574 articles of *JGSI* in the Web of Science (WoS) database for the period 2013 to 2022. The annual growth of articles during the last ten years (2013 to 2022) shows an increasing trend, except for 2020, the Covid year (Fig. 1). The average number of articles per year was 157.4 from 2013-2022 (Table 1). From 2013 to 2020, there is an unstable trend in the number of articles. From the data given in the table, it is clear that 2022 happened to be the most productive year, with 201 (12.78%) articles, followed by the year 2018 (183, 11.63%) and the year 2017 (177, 11.25%). Most probably the Covid years of 2020 and 2021 had a negative impact on the number of papers published.

5.2. Highly Cited Papers Published During the Period 2013-2022

The top 10 most cited papers published during the period 2013-2022 received a total of 693 citations with a citation range of 52–125 (minimum 52 and maximum 125) in WoS. The average citation per top-cited paper is 69.3. Table 2 lists the top cited 10 papers (at least 52 or more citations of the JGSI in WoS). Out of 10 top-cited papers, only one paper has at least 100 or more citations. The first ranked most cited paper with 125 citations (citation density 15.625) in WoS was "Hydrogeochemical investigation and groundwater quality assessment of Pratapgarh district, Uttar Pradesh", authored by Tiwari and Singh (2014). The
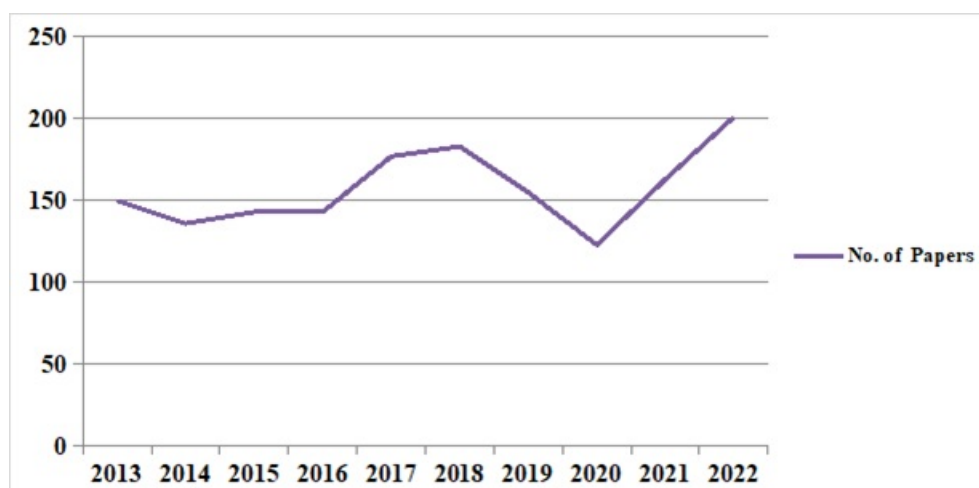
Fig. 1. The no.of papers published in JGSI and indexed in WoS during 2013-2022 *(Source: WoS data)*.

Table 2. Ten highly-cited papers published during the period 2013-2022.

| Rank	Title	Authors & affiliations	Year	Number of Citations	Citation per year (Rank)
1	Hydrogeochemical investigation and groundwater quality assessment of Pratapgarh district, Uttar Pradesh	Tiwari and Singh CSIR — Central Institute of Mining and Fuel Research	2014	125	15.625 (4)
2	Landslide Susceptibility Mapping Using Analytical Hierarchy Process (AHP) in Tehri Reservoir Rim Region, Uttarakhand	Kumar and Anbalagan Department of Earth Sciences, Indian Institute of Technology, Roorkee	2016	98	16.33 (2)
3	Hydroclimatological Perspective of the Kerala Flood of 2018	Mishra and Shah Civil Engineering, Indian Institute of Technology Gandhinagar	2018	65	16.25 (3)
4	Formal Subdivision of the Holocene Series/Epoch: A Summary	Walker et al. School of Archaeology, History and Anthropology, University of Wales Trinity Saint David, & Department of Geography and Earth Sciences, Aberystwyth University	2019	63	21 (1)
5	Time Series Analysis of Groundwater Levels and Projection of Future Trend	Patle et al. Department of Soil and Water Engineering, College of Agricultural Engineering and Post Harvest Technology, Gangtok, & Water Technology Centre, Indian Agricultural Research Institute, New Delhi	2015	63	9 (9)
6	Landslide susceptibility assessment using Information Value Method in parts of the Darjeeling Himalayas	Sarkar et al. Department of Geography, Banaras Hindu University, India & Geosciences Division, National Remote Sensing Centre, Hyderabad,	2013	59	6.56 (10)
7	Assessment of groundwater potential zone using remote sensing, GIS and multi criteria decision analysis techniques	Jhariya et al. Department of Applied Geology, National Institute of Technology Raipur,	2016	57	9.5 (8)
8	Groundwater quality assessment for drinking purpose in Raipur city, Chhattisgarh using water quality index and geographic information system	Khan and Jhariya Department of Applied Geology, National Institute of Technology Raipur,	2017	57	11.4 (7)
9	Remote Sensing and GIS Based Groundwater Potential Zone Mapping in Ariyalur District, Tamil Nadu	Gnanachandrasamy et al. School of Earth Science and Engineering, SunYat- Sen University, Guangzhou, 510275, China	2018	54	13.5 (5)
10	Groundwater Quality assessment using Water Quality Index (WQI) in parts of Varanasi District, Uttar Pradesh, India	Chaurasia et al. Department of Geology, Institute of Science, Banaras Hindu University,	2018	52	13 (6)
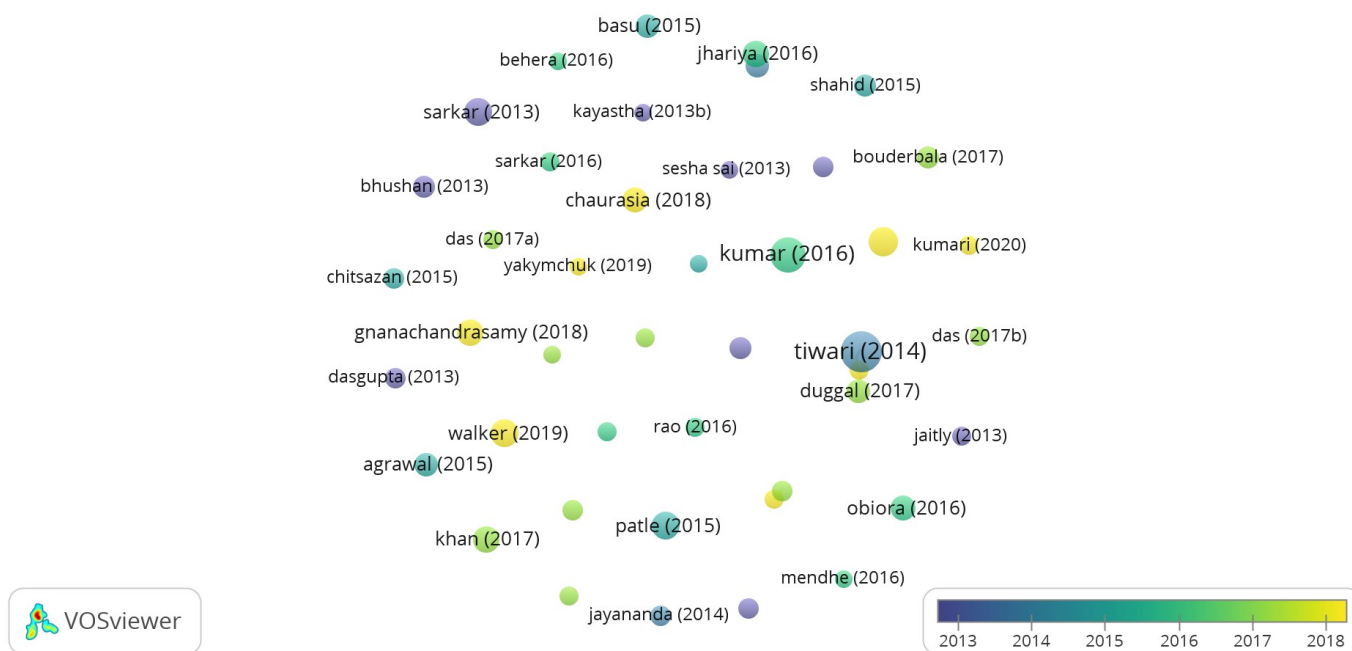
Fig. 2. Time line view of highly cited papers published in *JGSI* during the period 2013-2022.

second-ranked most cited paper with 98 citations (citation density 16.33) was "Landslide Susceptibility Mapping Using Analytical Hierarchy Process (AHP) in Tehri Reservoir Rim Region, Uttarakhand" by Kumar and Anbalagan (2016). The third most cited paper with 65 citations (citation density 16.25) was "Hydroclimatological Perspective of the Kerala Flood of 2018" by Mishra and Shah (2018).

Fig. 2 shows the map of highly cited papers (44 articles with at least 25 or more citations) published in *JGSI* during the period 2013-2022. The name of the first author and year of publication are shown on the spheres, whose size is proportionate to number of citations and colour represents the year of publication of the highly cited papers. Yellow colored circles represent relatively newly published most cited papers.

5.3. Most Productive Authors of the Papers Published during the Period 2013-2022

During the specified period, the *JGSI* featured contributions from 3,873 authors, with the possibility of non-unique authorship. Table 3 provides a concise summary of the eight most prolific authors, each of whom authored a minimum of 10 papers in *JGSI* within this timeframe. To offer a comprehensive overview of each author's scholarly output, the table encompasses various bibliometric indicators, including author names, the number of papers authored, their affiliations, ranks, citation counts, and citations per paper.

The top three exceptionally prolific authors in *JGSI* during this period were as follows:

1. T.N. Singh, affiliated with the Department of Earth Science at the Indian Institute of Technology, Mumbai, contributed 17 papers.
2. Kalachand Sain, hailing from the Wadia Institute of Himalayan Geology (WIHG), Dehradun and Prakash K Singh, Banaras Hindu University authored 16 papers each.
3. Hema Achyuthan, representing the Department of Geology at Anna University, Chennai, presented 13 papers.

Following closely were Sanjith Kumar Pal, Ghulam M Bhat, D.K. Sinha and R.C. Mehrothra who authored 10 papers each.

Furthermore, among these productive authors, the top three individuals who demonstrated the highest influence, as measured by citations per paper, were as follows:

1. Sanjith Kumar Pal associated with the Indian Institute of Technology, Dhanbad exhibited a remarkable citation rate of 15.4.
2. T.N. Singh, from the Department of Earth Science at the Indian Institute of Technology,

Table 3. Most prolific authors of the papers published in *JGSI* during the period 2013-2022.

Rank	Author name	Number of papers	Affiliation*	Number of citations	Citations per paper (Rank)
1	T.N. Singh	17	Department of Earth Science, Indian Institute of Technology, Mumbai	172	10.12 (2)
2	Kalachand Sain	16	Wadia Institute of Himalayan Geology (WIHG), Dehradun	77	4.81 (5)
3	Prakash K Singh	16	Banaras Hindu University	138	8.63 (3)
4	Hema Achyuthan	13	Anna University, Department of Geology, Chennai	93	7.15 (4)
5	Sanjith Kumar Pal	10	Indian Institute of Technology (Indian School of Mines), Dhanbad	154	15.4 (1)
6	Ghulam M Bhat	10	Department of Geology, University of Jammu	40	4 (6)
7	D.K Sinha	10	Atomic Minerals Directorate for Exploration & Research (AMD), Hyderabad, Telengana	18	1.8 (8)
8	R.C. Mehrothra	10	Birbal Sahni Institute of Palaeobotany (BSIP), Lucknow	31	3.1 (7)

*Authors affiliations are based on their author IDs in WoS.
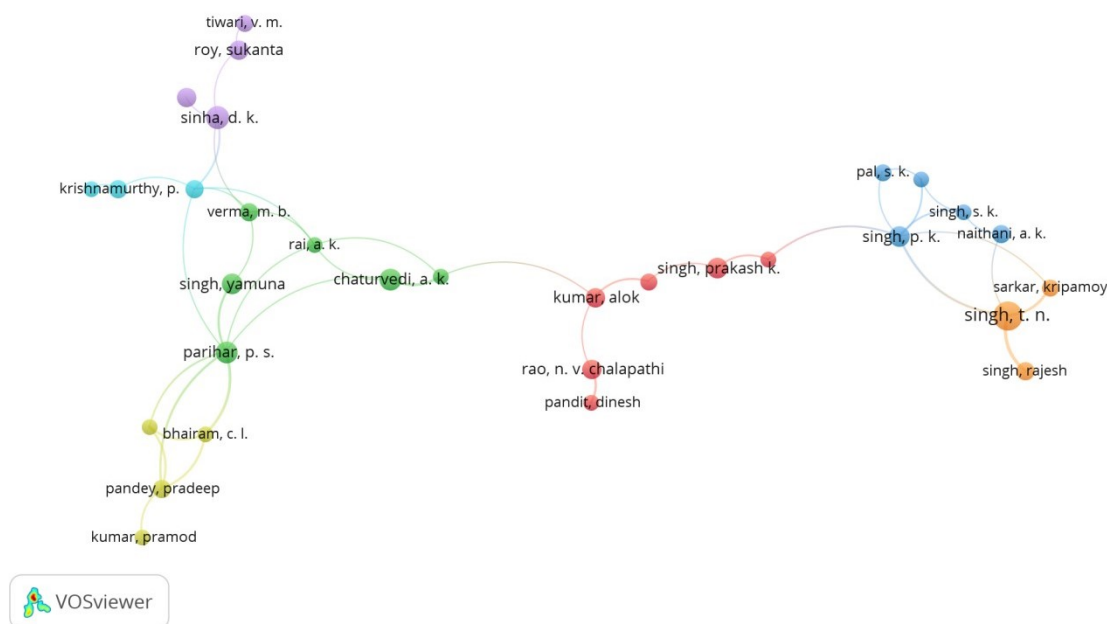
Fig. 3. Co-authorship network map of *JGSI*.

Mumbai, demonstrated a citations-per-paper score of 10.12.

3. Prakash K Singh of the Banaras Hindu University, achieved a notable score of 8.63 in terms of citations per paper.

This list is different from that of Maraddi et al. (2023) because of the larger interval of assessment (2002–21), and also because the authors have not distinguished editorials from original research papers. Hence B.P.Radhakrisna, the former editor of the JGSI is reported as the most productive author, mostly because of his editorial notes in almost all issues of the journal. Table 3. Most productive authors of the papers published in *JGSI* during the period

2013-2022.

Fig. 3 presents a co-authorship network map of the authors, which signifies collaborations among researchers within the context of published works. The visualization employs distinct clusters, each denoted by a unique color, to represent groups of authors with shared research affiliations. Within these clusters, nodes, represented as circles, correspond to individual authors. The size of these nodes is contingent upon several factors, including the author's publication output, connections within the network, and the strength of these connections.

Authors who are closely situated within the same cluster or interconnected in clusters reflect a stronger association in their collaborative research endeavors.

Fig. 4. Institute co-authorship network map of *JGSI*.

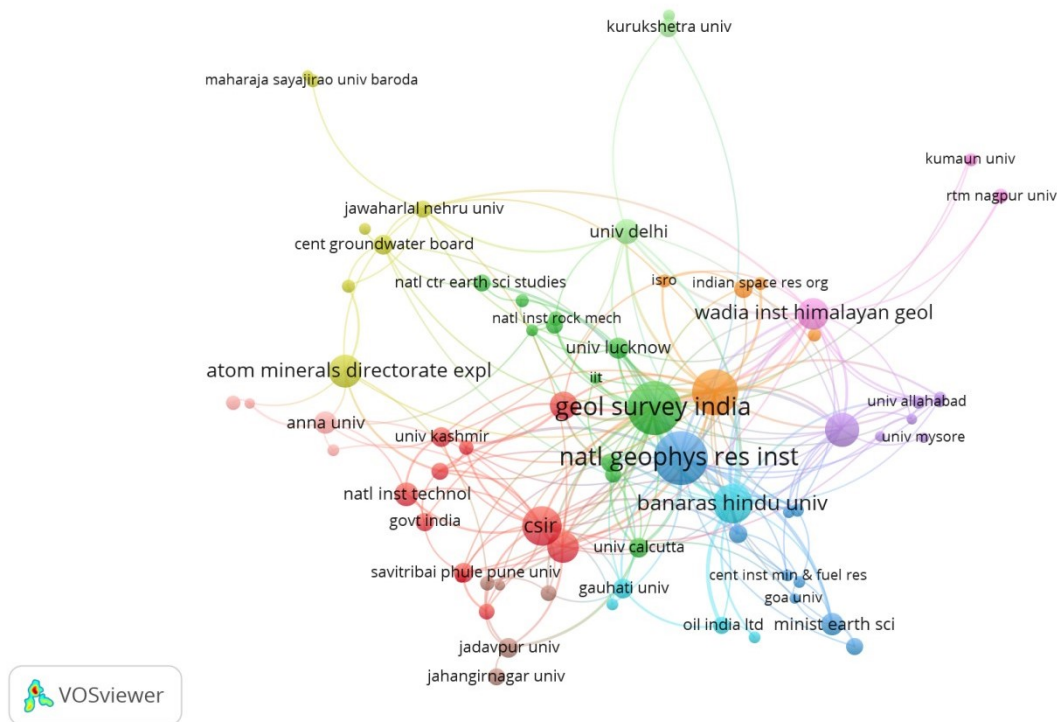In this co-authorship network depicted in Fig. 3, we considered authors with a minimum of five published papers. This network comprised 31 authors distributed across seven distinct clusters.

Notably, the core authors within these co-authorship clusters were Alok Kumar, P S Parihar, P K Singh, D K Sinha, Pradeep Pandey, P Krishnamurthy, and T N Singh. The clusters delineate specific research groups, such as a cluster centered at Banaras Hindu University led by Alok Kumar, another group of engineering geologists associated with IIT Mumbai led by T N Singh, and an Atomic Minerals Division group featuring P Krishnamurthy, D K Sinha, and Pradeep Pandey. These insights illuminate the collaborative patterns and research affiliations among authors within the field of study.

5.4. Most Productive Institutions of the papers published during the period

Among the papers analyzed, the corresponding authors were associated with a total of 1007 distinct institutions. The Geological Survey of India emerged as the most prolific contributor with 118 affiliations, closely followed by the National Geophysical Research Institute, which accounted for 117 affiliations, and the Indian Institutes of Technology (IITs) with 89 affiliations.

For the purpose of institute co-authorship analysis, institutions with a minimum of five papers were included, leading to the formation of a network comprised of 73 institutions distributed across eleven clusters (Fig. 4). In this network, the Geological Survey of India occupied the top position with 27 connections and an aggregated link strength totaling 49. The National Geophysical Research Institute secured the second position with 23 connections and an equivalent link strength of 49. This depiction underscores the institutional collaborations within the research landscape, with particular emphasis on the prominent roles played by the Geological Survey of India and the National Geophysical Research Institute in facilitating scholarly engagement in geology in India.

5.5. Most Productive Countries of the papers published during the period

As a journal with an international scope in the field of Geology, *JGSI* has attracted the interest of many researchers worldwide. Authors from 58 countries made contribution to *JGSI* during the period. The most productive countries in *JGSI* from 2013 to 2022 are naturally headed by India with 1280 papers followed by China (36), Iran (35), Nigeria (29),
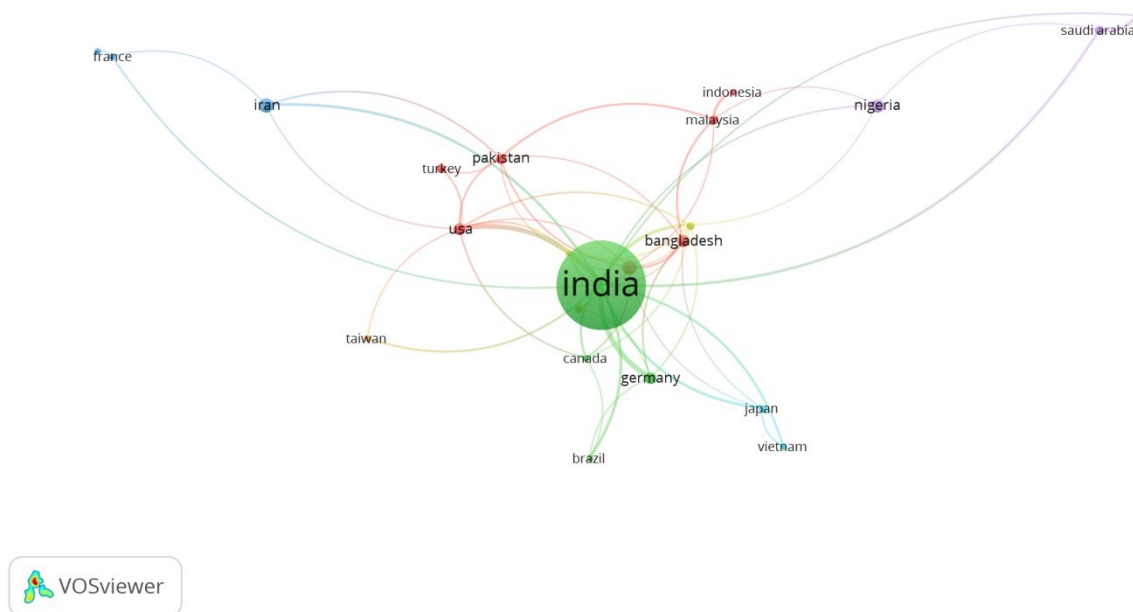
Fig. 5. Country co-authorship network map of *JGSI*.

Table 4. Top 20 highly-frequent keywords of *JGSI* papers published during the period 2013-2022.

Rank	Keyword	Frequency	Rank	Keyword	Frequency
1	Andhra Pradesh	25	11	Uttar Pradesh	13
2	Gujarat	24	12	Bangladesh	13
3	Ground water	22	13	Odisha	13
4	Geochemistry	20	14	Central India	13
5	Tamilnadu	20	15	Slope Stability	12
6	GIS	18	16	Maharashtra	12
7	Rajasthan	16	17	Groundwater Quality	11
8	Himalaya	15	17	Nigeria	11
9	Madhya Pradesh	14	19	Meghalaya	10
10	Iran	14	20	West Bengal	10

followed by Germany, USA and Bangladesh with 25 papers each.

Country co-authorship map was generated with the threshold of five and 23 countries were visualized. Fig. 5 shows the country co-authorship network in *JGSI* during the period 2013-2022. In the mapped network, countries with at least five papers were included. The network consisted of seven clusters. The red circles in the first cluster consisted of the seven countries. The second cluster of green circles involved the authors of four countries. The blue, orange and purple circles represent the third, fourth and fifth clusters respectively and these clusters contain three countries each.

In Fig. 5, distinct nodes correspond to individual countries, with the size of these nodes reflecting the level of activity and the number of publications attributed to each country. Lines connecting nodes signify the existence of co-authorship relationships. Notably, owing to *JGSI*'s focus on India, the coun-try naturally emerged as the most prolific contributor, both in terms of the volume of papers produced and the number of co-authoring nations. A database query yielded 258 papers, none of which had authors affiliated with Indian institutions. Diverse international collaborations have been fostered by authors from India, encompassing major developed nations as well as extensive engagement with most ASEAN and neighboring countries.

5.6. Keywords Clustering of *JGSI* papers published during the period

Out of the 1,918 author keywords employed across the papers, Table 4 showcases the 20 most frequently used keywords during the 2013-2022 period. These keywords are arranged in descending order of frequency and encompass: Andhra Pradesh, Uttar Pradesh, Gujarat, Bangladesh, Groundwater, Odisha, Geochemistry, Central India, Tamilnadu, Slope Stability, GIS, Maharashtra, Rajasthan,
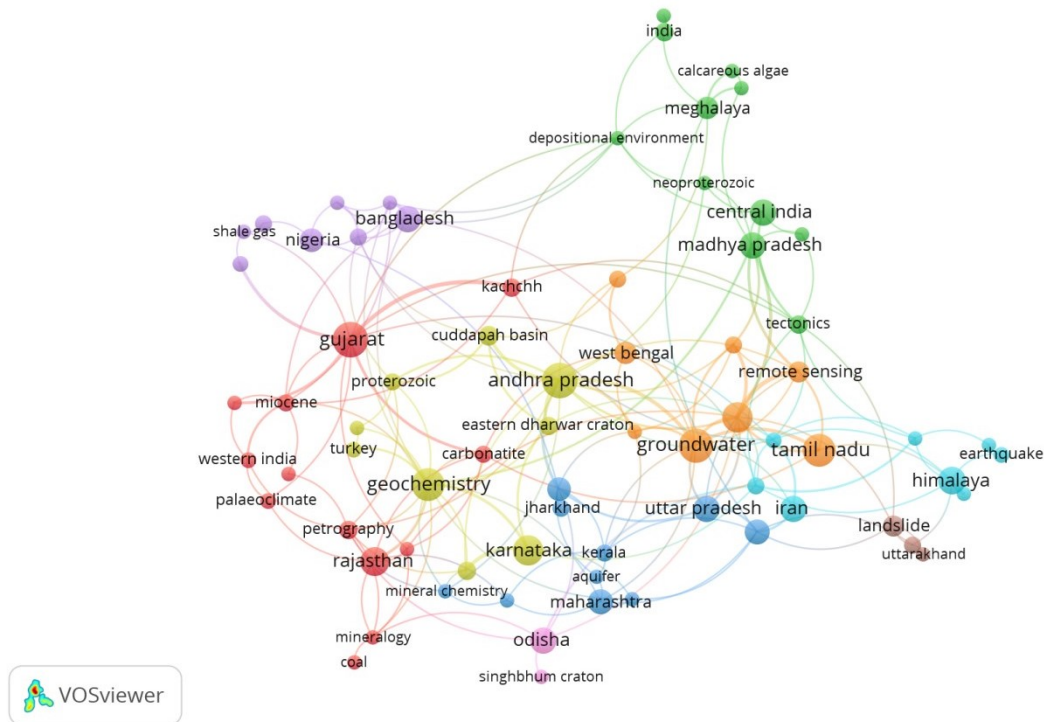
Fig. 6. Keyword co-occurrence map (The size of the nodes represents the frequency of the keywords, with larger nodes indicating higher frequency. The thickness of the edges is related to the closeness of the interactions between two nodes. Note that the colors of the nodes of the keywords indicate the cluster to which keywords belong).

Groundwater Quality, Himalaya, Nigeria, Madhya Pradesh, Meghalaya, Iran, and West Bengal. This ranking underscores the predominance of groundwater and landslide research within JGSI during this period.

In Fig. 6, the visualization of keyword co-occurrence networks elucidates the amalgamation of domain knowledge. As Radhakrishnan et al. (2017) opined, valuable insights can be derived from literature term patterns and link strengths. Notably, nine keyword clusters emerged, incorporating 72 keywords in total.

The first cluster, highlighted in red, comprises 13 keywords, including Gujarat, Rajasthan, Kutch, Petrography, and Miocene. This cluster signifies substantial research focused on the geology of the Kutch region, as well as broader geological investigations in Gujarat and Rajasthan, with a notable emphasis on sedimentology and hard rock geology. The green-colored second cluster encompasses 11 keywords, featuring terms such as Bay of Bengal, Bundelkhand Craton, and Tectonics. This cluster reflects sustained interest in sedimentation within the Bay of Bengal region and the mechanisms underlying crustal evolution, particularly centered around

cratons like Bundelkhand. The third cluster, depicted in blue, encompasses 10 keywords, including Acqifer, Deccan Traps, and XRD. This cluster underscores research areas such as aquifer studies, the Deccan Traps, and mineralogical analyses. The yellow-themed fourth cluster comprises nine keywords, including Andhra Pradesh, Cuddapah Basin, and Geochronology, highlighting themes related to geological aspects of Andhra Pradesh and its surroundings. The fifth cluster, in purple, includes eight keywords like Bangladesh, Bengal Basin, and Shale Gas, showcasing interest in geological aspects within the context of Bangladesh and related basins. The vivid sky blue sixth cluster comprises keywords like Earthquake, GPS, and Himalaya, reflecting research on seismic activities and geodetic aspects, particularly within the Himalayan region. The orange seventh cluster contains keywords such as Fluoride, GIS, and Watershed, indicating research domains involving water quality, geospatial analysis, and watershed management. The brown eighth cluster encompasses three keywords, namely Himachal Pradesh, Landslide, and Uttarakhand, spotlighting research areas associated with landslides in these regions. Finally, the violet ninth cluster includes just two keywords,

Table 5. Cited Sources in *JGSI* Papers.

Rank	Source	Citations	IF (2022)	CiteScore (2022)
1	Journal of Geological Society of India (Springer)	2615	1.3	2.2
2	Current Science (Indian Academy of Sciences)	872	1	1.7
3	Tectonophysics (Elsevier)	725	2.9	5.8
4	Precambrian Research (Elsevier)	710	3.8	7.2
5	Earth and Planetary Science Letters (Elsevier)	694	5.3	10.3
6	Geochimica et CosmochimicaActa (Elsevier)	625	5	9.4
7	Journal of Asian Earth Sciences (Elsevier)	609	3	6.3
8	Nature (Springer)	520	64.8	83.4
9	Geological Society of America Bulletin (Geol Soc. of America)	508	4.9	9.2
10	Chemical Geology (Elsevier)	479	3.9	7.6
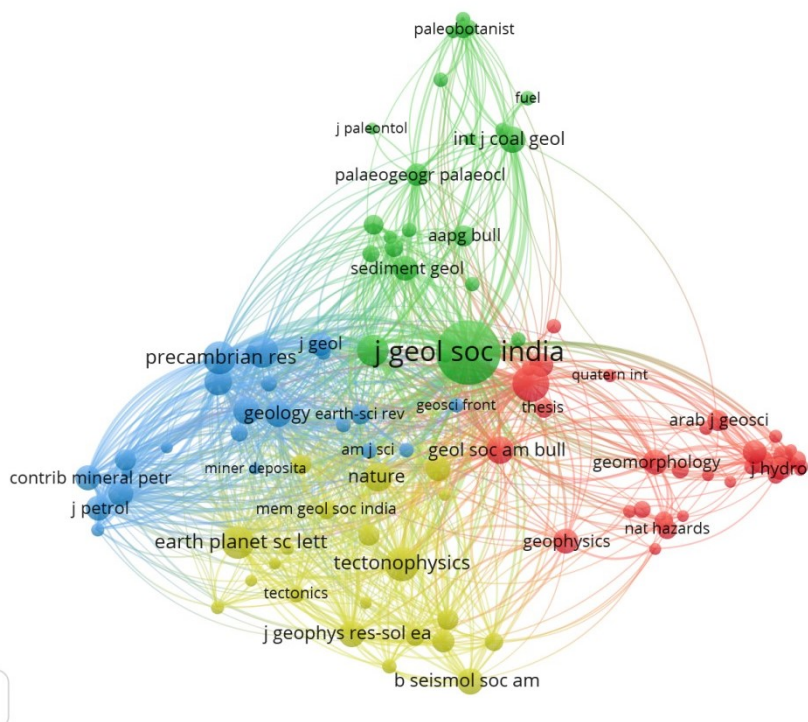
Fig. 7. Co-citation network map of sources cited in paper in *JGSI*.

Odisha and Singhbhum Craton, hinting at research concentrations in Odisha and the geological aspects of the Singhbhum Craton, the most mineral resource rich craton in India.

5.7. Cited Sources in *JGSI* Papers Published during the period 2013-2022

An examination of the references within papers published in the *JGSI* during the specified period revealed a total of 14,627 cited sources. Table 5 presents the ten most frequently cited sources, shedding light on influential publications that actively contribute to the current research landscape and have the potential to shape future research directions. WoS serves as a valuable resource for discerning active journals that encompass pertinent and contemporary research while exerting influence on prospec-

tive research domains. Within WoS, the journal impact factor (JIF), as pioneered by Garfield (1999, 2005), stands as the central metric for ranking journals. Notably, despite *Nature* boasting the highest impact factor, it occupies the eighth position among the most cited sources within *JGSI*. Conversely, *Current Science*, published by the Indian Academy of Sciences in Bangalore, India, stands as the second most frequently cited source.

The remaining top-cited sources align with high-impact and esteemed geology journals, including *Geochimica et Cosmochimica Acta, Earth and Planetary Science Letters*, and *Geological Society of America Bulletin*. To establish a threshold for highly cited sources, we considered those with at least 90 citations, resulting in the inclusion of the top 100 most cited sources, as depicted in Fig. 7. The co-citation

Table 6. Most cited authors in *JGSI* papers published during the period 2013-2022.

Rank	Author	Citations
1	P K Singh	161
2	Harsh K Gupta	155
3	S Kumar	153
4	S K Biswas	133
5	K S Valdiya	114
6	A K Singh	109
7	A Kumar	95
8	S K Acharyya	85
9	S Selvam	84

map in Fig. 7 underscores *JGSI* as the most highly cited source, an expected outcome since authors often cite papers from the journal they intend to publish in Gastel and Day (2022). The co-citation map reveals four distinct clusters:

1. The green cluster, encompassing paleontology, paleogeography, and mineral fuels, demonstrates strong interconnections.
2. The blue cluster, centered on solid earth, petrology, and ore geology, signifies another cohesive grouping.
3. The yellow cluster, focused on tectonics and geophysics, forms a well-connected group.
4. The red cluster, involving geomorphology, hydrogeology, and natural hazards, exhibits relatively weaker connections with the other groups.

JGSI assumes a central position within this co-citation map, illustrating its comprehensive coverage of diverse geological domains. Notably, despite its predominantly geoscience-oriented content, the *Journal of Earth System Sciences* of the Indian Academy of Sciences does not feature among the top ten cited sources within *JGSI*, suggesting variations in citation patterns within the field.

5.8. Cited Authors in *JGSI* Papers Published during the period 2013-2022

During the period spanning 2013-2022, papers published in *JGSI* cited a notable total of 25,135 distinct authors. Table 6 provides a glimpse into the nine most frequently cited authors within this timeframe, revealing PK Singh as the foremost cited author with an impressive tally of 161 citations, closely pursued by Harsh K Gupta with 155 citations, and S Kumar with 153 citations.

To facilitate a more comprehensive exploration of author co-citation dynamics, we introduced a citation

threshold of 30 citations, thereby encompassing 143 authors who had received at least this number of citations in the co-citation map (Fig. 8). The co-citation map unveils a complex landscape, characterized by eight distinct clusters:

1. The red cluster represents the largest, featuring 34 authors, with S Kumar emerging as the most influential, having been cited 153 times.
2. The green cluster, the second-largest, comprises 28 cited authors, with Harsh K Gupta and K S Valdiya as the most influential cited authors, accumulating 155 and 114 citations, respectively.
3. The blue cluster encompasses 25 authors, with S K Acharyya as the most influential, cited 85 times.
4. The yellow cluster, containing 22 cited authors, showcases S Selvam (VOC College, Tuticorin, Tamil Nadu) as the most influential, having received 84 citations within *JGSI* papers.
5. The purple cluster includes 15 authors, with P K Singh and A K Singh emerging as the most influential, cited 161 and 109 times, respectively.
6. The blue cluster, distinct from the third cluster, involves seven authors, with D C Mishra as the most influential, having garnered 67 citations.
7. The orange cluster is anchored by S K Biswas, the most influential author, with an impressive 133 citations.
8. Finally, the violet cluster encompasses six authors, with Z T Bieniawski as the most influential, cited 71 times.

This co-citation map unveils intricate patterns of author influence within the geological research domain. It highlights the crucial roles played by various authors and their extensive contributions to the scholarly discourse within *JGSI*.

6. DISCUSSION AND CONCLUSION

From 2013 to 2022, the publication trends within *JGSI* exhibit a degree of fluctuation, notably marked by instability. This temporal instability, while partially attributed to the disruptive influence of the COVID-19 pandemic during 2020 and 2021, finds its roots dating back to 2018. Encouragingly, the post-pandemic era has witnessed a resurgence in publications, culminating in the highest annual publication count ever recorded by *JGSI*, notably in 2022.

Fig. 8. Co-citation network map of authors cited by *JGSI*.

The resurgence aligns with broader trends observed in STEM and medical journals, where the reasons underpinning increased submissions following Covid pandemic-related disruptions have been a subject of scholarly inquiry (Harper et al., 2020). The COVID-19 pandemic significantly impacted the pace and nature of scientific research, leading to a noticeable surge in journal paper publications in the post-pandemic period. This increase is partly attributed to the shift towards remote work, which allowed researchers to focus more on writing and publishing their findings. Additionally, the pandemic spurred a wave of collaborative efforts and accelerated the review processes for COVID-19-related research, setting a precedent that continued into other fields. A study by Elsevier reported a 35% increase in submissions to their journals during the first year of the pandemic compared to the previous year (Elsevier, 2021). Similarly, Springer Nature observed a 58% increase in submissions in the first half of 2020 alone (Springer Nature, 2020). These trends reflect an overall boost in scientific productivity, and this global trend is reflected in the *JGSI* also. Furthermore, Harper et al. (2020) noted that the pandemic highlighted the importance of rapid dissemination of scientific knowledge, prompting journals to streamline their publication processes. This urgency, ini-

tially centered around COVID-19 research, has had a lasting impact on the efficiency of scientific publishing across various disciplines, including geology.

In assessing *JGSI*'s impact and influence within the realm of Geology, the highly cited papers published during this period serve as a tangible marker of the journal's trajectory, underscoring its appeal to researchers seeking to contribute to the field. The authors whose work garners high citation counts within *JGSI* are internationally recognized figures in the realm of Geoscience and its associated disciplines. However, an analysis of contributing authors, institutions, and countries reveals a geographic concentration, predominantly centered in India. This regional skew is apparent when examining *JGSI*'s co-authorship network, reflecting limited international collaboration. It is plausible that manuscripts involving international collaborations gravitate towards foreign journals. Nonetheless, several Indian institutions, such as GSI, NGRI, WIHG, AMD, and BHU, play pivotal roles in facilitating collaborative geological research within the country. This trend resonates with the global phenomenon of multi-disciplinary approaches and cross-institutional cooperation, bolstered by improved access to advanced instrumentation and opportunities for innovative research (Sonnenwald, 2007; Sampaio et al., 2016; Beaver, 2001;

Laudel, 2002; Smithwick et al., 2019; Fonseca et al., 2016). Despite an increasing representation of female scholars in Geology postgraduate programs in India, the gender skew in *JGSI* publications is evident, as illustrated in Tables 2 and 3. The underrepresentation of women authors, including no female authors in the list of most cited papers and only one in the list of most prolific authors (Hema Achuthan), is a concern. This gender imbalance, observed during the COVID-19 pandemic (Viglione, 2020), may necessitate a dedicated study to understand the factors contributing to the low representation of female authorship in *JGSI*, which might, in turn, reflect broader disparities within geological research, industry, and academia in India (Mishra et al., 2016). Nevertheless, the majority presence of female scholars in Geology postgraduate programs presents an encouraging sign for future gender diversity in the field (AISHE, 2022). A notable observation in *JGSI* is the utilization of Academic Social Networking Sites by authors to enhance the visibility and impact of their papers, particularly evident given the limited number of papers with 50 or more citations in WoS. The non-open-access nature of *JGSI*, along with potential access restrictions, could be constraining citation counts. This situation suggests a potential feedback loop wherein eminent Indian geologists may not choose *JGSI* for publication due to its lower impact factor, and as a result, the journal's impact factor remains modest, notwithstanding the presence of globally renowned geoscientists based in India who have contributed high-impact papers to *JGSI* (Renjith and Pradeep-kumar, 2021).

The content analysis of *JGSI*'s highly cited papers reveals a thematic concentration, with seven of the top ten highly cited papers centered around groundwater, two addressing landslides, and one focusing on stratigraphy. This thematic coherence aligns with findings from keyword co-occurrence analysis, reaffirming *JGSI*'s comprehensive coverage of diverse geology topics. The co-citation network analysis exposes *JGSI*'s citation patterns, highlighting its citations of key sources within the Geosciences domain. These co-citations bolster the quality of papers published in the journal, thereby attracting more citations and bolstering *JGSI*'s influence. The broader co-citation network of journals referenced in *JGSI* papers underscores the journal's logical interrelations with other related and intersecting fields. In sum, *JGSI* retains its position as a preferred outlet for core

geological research contributions within India, as well as its active engagement with the global geological research landscape.

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