Boris Chigarev ORCID 0000-0001-9903-2800 https://figshare.com/authors/Boris_Chigarev/6474086

!!! In main links in this report were relative, pls. use HTML file in download archive from figshare.com to use them (https://figshare.com/s/9cfc435ba3c47429dace)!!!

Sulphate Reducing in the Geological Context. 2010-2019. Bibliometric Analysis

Motivation:

> The impact of SRB metabolic activities can modify the overall geochemistry of the sedimentary package. For example, in many environments, more than 50% of the total carbon mineralization (oxidation) is due to SRB (Canfield and Des Marais, 1993; Jorgensen, 1982). See more: https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/sulfate-reducing-bacteria

Objectives:

- bibliometric analysis of the topic: "Sulphate reducing in the geological context. 2010-2019"
- analyze bibliometric data from Lens, OnePetro, Scopus and WoS databases
- depicts flows of bibliometrics data by using a Sankey diagrams
- implement bibliometric network analysis by using VOSviewer software
- extract keywords and keyphrases for topic description

Main query: TITLE-ABS-KEY ((sulfate-reducing) AND geolog*) AND PUBYEAR > 2009

Substantial discovery: the intermittent increase of usage the term “sulfur compounds” when 2015 witch can’t be explained by the rise of the number of publications. The item for further study: does increase attention to sulfur compounds concern to water pollution? The possible start point for further investigation of this issue: "In-situ hydrogen sulfide mitigation". 2019-10-10 publication of US20190309213A1. Claims: A method of reducing an amount of a sulfur-containing compound in a reservoir fluid...

Common remark on data representation in this research:

- tables in the report file contain only data examples, full results are in files named in the remark under the table
- large (by Kbytes) figures are placed only on Figshare.com, this report contain only direct links to them
- you could download all files collection from Figshare.com as zip archive
- all links to tables with full data for this report are relative, so you could use them while using download archive
- most image files are in SVG format, so you could enlarge them to convenient scale
- number in filename concern data results, for example: Scopus-539..., Lens_1080...

Lens.org

Main items:

- to collate 'Field of Study' with other fields of Lens bibliometric table such as Source Country, Funding, Source Title
- build Sankey diagrams based on this collations
- use 'Field of Study' as KWs for VOSViewer

Table 1. The example of data. 'Field of Study' vs 'Funding (contain 'China' in naming)' using 1080 scholarly dataset from Lens.org DB

'Field of Study'	Funding
Geology	National Natural Science Foundation of China
Anaerobic oxidation of methane; Environmental chemistry; Chemistry; Desulfobacteraceae; Sulfate; Sediment; Methane; Sulfur; Waste management; Archaea; Mud volcano	National Natural Science Foundation of China
Ecosystem; Contamination; Biodiversity; Soil microbiology; Ecology; Functional shift; Environmental pollution; RNA RIBOSOMAL 16S; Microbial ecology; Biology; Microbiology	National Natural Science Foundation of China
Oceanic crust; Basalt; Ecology; Crust; Mid-Atlantic Ridge; Marinobacter; Geomicrobiology; Ridge; Documentation; Biology	National Natural Science Foundation of China
Contamination; Ecology; Sediment; Diversity index; Arsenic; Mercury (element); Genetic variation; Biogeochemical cycle; Microbial population biology; Biology	National Natural Science Foundation of China
Environmental chemistry; Carbon sequestration; Methanosarcinales; Methanogenesis; Formate; Bicarbonate; Formate oxidation; Methane; Carbon dioxide; Biochemistry; Biology; Microbiology	National Natural Science Foundation of China
Coal mining; Drainage basin; Geochemistry; Radiochemistry; Karst; Chemistry; Gypsum; Sulfide; Sulfur; Groundwater; Surface water	National Natural Science Foundation of China
Anaerobic oxidation of methane; Cold seep; Metagenomics; Microorganism; Ecology; Nitrate; Sulfurimonas; Sulfur; Bacteria; Biochemistry; Biology	National Natural Science Foundation of China
Geomorphology; Authigenic; Geology; Facies; Marine ecosystem; Paleontology; Lithification; Lamination (geology); Cyanobacteria; Dolomite; Stromatolite	National Natural Science Foundation of China;
Ecology; Psychrobacter; Alishewanella; Arsenic; Drainage; Aquifer; Groundwater; Microbial population biology; Biology; Irrigation	National Natural Science Foundation of China
Geology; Inorganic chemistry; Sulfate-reducing bacteria; Chelation; Sulfate; Sulfide; Sulfur; Flue-gas desulfurization; Absorption (pharmacology); Denitrification	National Natural Science Foundation of China;

'Field of Study'	Funding
Environmental chemistry; Total organic carbon; Chemistry; Bioremediation; Microbial consortium; Sulfate; Methanogenesis; Sediment; Pollution; Microbial population biology	National Natural Science Foundation of China;
Authigenic; Geology; Extracellular polymeric substance; Diagenesis; Geochemistry; Sulfate; Methanogenesis; Ankerite; Dolomite; Carbonate	National Natural Science Foundation of China;
Geology; Geochemistry; Sulfate-reducing bacteria; Mineralogy; Pyrite; Sphalerite; Sulfide minerals; Sulfide; Galena; Sulfur; Volcanogenic massive sulfide ore deposit	National Natural Science Foundation of China;
Environmental chemistry; Total organic carbon; Chemistry; Geobacter; Sulfate; Sediment; Geologic Sediments; Alluvial plain; Biogeochemical cycle; Aquifer	National Natural Science Foundation of China;
Environmental chemistry; Algal bloom; Water column; Chemistry; Eutrophication; Sulfate; Sulfide; Phosphorus; Algae; Sulfur cycle	National Natural Science Foundation of China;
Environmental chemistry; Water column; Chemistry; Eutrophication; Sulfate; Phosphorus; Sulfur; Cycling; Mineralization (biology); Dissolution	National Natural Science Foundation of China;

Remark: The name of file in collection of full data: Lens_1080_LIKE China Funding - Field of Study.csv

Table 2. Top 50 'Field of Study' as Key Words for 'Funding (contain 'China' in naming)' using 1080 scholarly dataset from Lens.org DB

keyword as 'Field of Study'	occurrences	total link strength
geology	21	123
chemistry	20	117
geochemistry	13	85
sulfate-reducing bacteria	13	74
sulfate	12	78
biology	11	57
ecology	11	58
environmental chemistry	11	73
sulfide	10	62
sulfur	10	67
carbonate	9	59
inorganic chemistry	9	51
sediment	9	59
geomorphology	7	45
authigenic	6	42
bacteria	6	37
microbial population biology	6	36

keyword as 'Field of Study'	occurrences	total link strength
anaerobic oxidation of methane	5	36
biogeochemical cycle	5	36
groundwater	5	24
methane	5	34
total organic carbon	5	32
calcite	4	27
diagenesis	4	27
anoxic waters	3	19
benthic zone	3	19
bioremediation	3	18
cold seep	3	22
contamination	3	15
dolomite	3	19
estuary	3	23
eutrophication	3	22
hydrothermal circulation	3	20
mercury (element)	3	21
methanogenesis	3	20
microbiology	3	12
pyrite	3	23
water column	3	22
acid mine drainage	2	13
actinobacteria	2	10
anaerobic exercise	2	14
ankerite	2	15
aquifer	2	11
aragonite	2	16
archaea	2	15
arsenic	2	12
bacteroidetes	2	10
biochemistry	2	12
biofilm	2	10
bioreactor	2	13

Remark: The name of file in collection of full data: Lens_1080_LIKE China Funding - Field of Study KW VOSviewer.tsv

The name of image file in collection build by VOSviewer: Lens_1080_LIKE China Funding - Field of Study KW VOSviewer.png

Table 3. The example of data. 'Field of Study' vs 'Source Title' (contain 'geo' in naming)' using 1080 scholarly dataset from Lens.org DB

Source title	Index Keywords as 'Field of Study'

Source title	Index Keywords as 'Field of Study'
Xinjiang Petroleum Geology	Chemistry; Hydrocarbon; Sulfate; Hydrogen sulfide; Carbonate; Cracking; Natural gas; Petroleum engineering
Swiss Journal of Geosciences	Anoxic waters; Geomorphology; Geology; Leaching (agriculture); Radiochemistry; Mineralogy; Pyrite; Nitrate; Dissolved organic carbon; Redox; Denitrification; Radioactive waste
Swiss Journal of Geosciences	Geology; Borehole; Geotechnical engineering; Sulphate reduction; Excavation; Organic matter; Radioactive waste
South African Journal of Geology	Biosphere; Structural basin; Geomorphology; Geology; Facies; Archean; Syncline; Early Earth; Greenstone belt; Paleoarchean
Sedimentary Geology	
Sedimentary Geology	Anaerobic oxidation of methane; Geomorphology; Authigenic; Geology; Cold seep; Chemosynthesis; Geochemistry; Ecology; Carbonate minerals; Carbonate; Organic matter; Archaea
Sedimentary Geology	Geomorphology; Geology; Diagenesis; Lithification; Geochemistry; Mineralogy; Calcium carbonate; Gypsum; Aragonite; Calcite; Carbonate; Cementation (geology)
Sedimentary Geology	Sedimentary depositional environment; Geology; Geochemistry; Microcrystalline; Fluid inclusions; Aragonite; Dolomite; Calcite; Petrography; Dolomitization
Sedimentary Geology	Cretaceous; Geology; Clastic rock; Paleontology; Aptian; Crato Formation; Calcite; Carbonate; LagerstΓ¤tte; Evaporite
Sedimentary Geology	Anoxic waters; Geomorphology; Water column; Geology; Iron bacteria; Overbank; Geochemistry; Pyrite; Sediment; Organic matter; Marl
Sedimentary Geology	Anaerobic oxidation of methane; Geomorphology; Geology; Situated; Paleontology; Geochemistry; Microorganism; Archaeol; Geological formation; Bacteria; Archaea; Mud volcano
Sedimentary Geology	
Sedimentary Geology	Lithology; Geology; Diagenesis; Geochemistry; Gypsum; Provenance; Carbonate; Evaporite; Sulfur; Petrography
Reviews of Geophysics	Geology; Magnetic susceptibility; Rock magnetism; Saturation (magnetic); Greigite; Single domain; Magnetization; Magnetic anisotropy; Magnetocrystalline anisotropy; Geophysics
Quarterly Journal of Engineering Geology and Hydrogeology	Geology; Nutrient cycle; Pollution; Ecosystem services; Aquifer; Groundwater; Microbial population biology; Pollutant; Environmental engineering; Resource management
Petroleum Geology & Experiment	Geomorphology; Source rock; Geology; Salinity; Diagenesis; Elevation; Geochemistry; Fault (geology); Hydrocarbon; Illite; Carbon dioxide
Organic Geochemistry	Geology; Residence time; Stoichiometry; Biodegradation; Organic chemistry; Denitrifying bacteria; Residual oil; Hydrocarbon; Sulfate; Chromatography; Petroleum
Organic Geochemistry	Total organic carbon; Organic chemistry; Chemistry; Terrigenous sediment; Stigmasterol; Phytoplankton; Alkane; Campesterol; Organic matter; Algae
Organic Geochemistry	Geology; Salinity; Biodegradation; Geochemistry; Methanogenesis; Pristane; Phytane; Alkane; Moderate extent; Alkalinity
Organic Geochemistry	
Organic Geochemistry	Diagenesis; Total organic carbon; Massif; Hopanoids; Organic chemistry; Chemistry; Dolomite; Sediment; Organic matter; Microbial mat

Source title	Index Keywords as 'Field of Study'
Ore Geology Reviews	Geology; Geochemistry; Volcanic rock; Felsic; Mineralogy; Albite; Chlorite; Sericite; Plagioclase; Illite; Quartz
Ore Geology Reviews	Lapilli; Geology; Diagenesis; Geochemistry; Volcanic rock; Felsic; Mineralogy; Chalcocite; Bornite; Chalcopyrite; Andesite
Ore Geology Reviews	Geology; Hydrothermal circulation; Geochemistry; Mineralogy; Sulfide minerals; Or34S; Sulfide; Sulfur; Seafloor massive sulfide deposits; Ore genesis; Volcanogenic massive sulfide ore deposit
Ore Geology Reviews	Geology; Geochemistry; Sulfate-reducing bacteria; Mineralogy; Pyrite; Sphalerite; Sulfide minerals; Sulfide; Galena; Sulfur; Volcanogenic massive sulfide ore deposit
Marine and Petroleum Geology	Geomorphology; Geology; Diagenesis; Clastic rock; Geochemistry; Ankerite; Calcite; Carbonate; Petroleum; Petrography; Cementation (geology)
Marine and Petroleum Geology	Anaerobic oxidation of methane; Geology; Ecology; Sulfate; Deltaproteobacteria; Methanogenesis; Methane; Archaea; Microbial population biology; Benthic zone
Marine and Petroleum Geology	Taphonomy; Anaerobic oxidation of methane; Geomorphology; Authigenic; Geology; Diagenesis; Holocene; Carbonate; Organic matter; Petroleum seep
Marine and Petroleum Geology	Anaerobic oxidation of methane; Anoxic waters; Ranging; Authigenic; Geology; Diagenesis; Geochemistry; Sulfide minerals; Sulfide; Sulfur
Marine and Petroleum Geology	Anaerobic oxidation of methane; Authigenic; Geology; Isotopes of carbon; Aptian; Sulfate-reducing bacteria; Carbonate; Sulfur; Petrology; Marl
Marine and Petroleum Geology	Anaerobic oxidation of methane; Geomorphology; Authigenic; Geology; Geochemistry; Siderite; Carbonate minerals; Aragonite; Calcite; Carbonate; Methane
Marine and Petroleum Geology	Natural gas field; Geomorphology; Geology; Geochemistry; Mineralogy; Anhydrite; Hydrocarbon; Dolomite; Carbonate; Methane; Carbon dioxide; Abiogenic petroleum origin

Remark: The name of file in collection of full data: Lens_1080_LIKE geo Source Title - Field of Study.csv

Table 4. Top 30 'Field of Study' as Index Keywords for 'Source Title (contain 'geo' in naming)' using 1080 scholarly dataset from Lens.org DB

'Field of Study' as Index Keywords	occurrences	total link strength
geology	141	1054
geochemistry	85	682
geomorphology	41	329
ecology	40	308
sulfate	40	338
sulfur	36	303
mineralogy	33	281
chemistry	32	252
carbonate	31	269
sulfate-reducing bacteria	27	210
organic matter	23	174
pyrite	22	186

'Field of Study' as Index Keywords	occurrences	total link strength
sediment	22	155
anoxic waters	21	166
anaerobic oxidation of methane	20	173
diagenesis	20	169
sulfide	20	175
inorganic chemistry	19	142
methane	19	144
paleontology	19	138
environmental chemistry	18	142
isotope fractionation	15	129
bacteria	14	105
sedimentary rock	14	112
authigenic	13	108
groundwater	13	97
biogeochemical cycle	11	89
calcite	10	88
hydrothermal circulation	10	86
seawater	10	87

Remark: The name of file in collection of full data: Lens_1080_LIKE geo Source Title - Field of Study KW VOSviewer.tsv

The name of image file in collection build by VOSviewer: Lens_1080_LIKE geo Source Title - Field of Study KW VOSviewer.png

RED cluster of the same image: Lens_1080_LIKE geo Source Title - Field of Study KW VOSviewer RED cluster.png

Table 5. The example of data. 'Field of Study' vs 'Source Title' (top 19 by number of publications)' using 1080 scholarly dataset from Lens.org DB

Source title	'Field of Study' as Index Keywords
Applied and Environmental Microbiology	Bioreactor; Desulfovibrio; Sulfate; Acetobacterium; Electron acceptor; Bacteria; Archaea; Biochemistry; Microbial population biology; Biology; Microbiology
Applied and Environmental Microbiology	Relative species abundance; Ecology; Turnover; Methanosarcinales; Methanogenesis; Population; Archaea; Microcosm; Microbial population biology; Biology; Microbiology; Zoology
Applied and Environmental Microbiology	Ecology; Sulfate-reducing bacteria; Acid mine drainage; Sediment; Bacteria; Archaea; Drainage; Biology
Applied and Environmental Microbiology	Ecology; Sulfate-reducing bacteria; Carbon fixation; Nitrate; Epsilonproteobacteria; Deltaproteobacteria; Desulfobacterales; Sulfide; Sulfur; Biology
Applied and Environmental Microbiology	Bay; Ecology; Sulfate; Sediment; Biology

Source title	'Field of Study' as Index Keywords
Applied and Environmental Microbiology	Microbial fuel cell; Chemistry; Bioelectrochemical reactor; Bioremediation; Toluene; Benzylsuccinate synthase; Electron acceptor; Sulfur; Biochemistry; Sulfur metabolism; Microbiology
Applied and Environmental Microbiology	Environmental chemistry; Biogeochemistry; Metagenomics; Dissimilatory sulfate reduction; Methanogenesis; Facultative; Biochemistry; Microbial ecology; Microbial population biology; Rainwater harvesting; Biology
Applied and Environmental Microbiology	Diazotroph; Terminal restriction fragment length polymorphism; Ecology; Bacteroidetes; Zostera; Deltaproteobacteria; Desulfobulbaceae; Zostera marina; Organic matter; Botany; Biology; Microbiology
Applied and Environmental Microbiology	Community structure; Cave; Ecology; Sulfate-reducing bacteria; Epsilonproteobacteria; Deltaproteobacteria; Species richness; Microbial ecology; Microbial population biology; Biology; Microbiology
Applied and Environmental Microbiology	Firmicutes; Acidiphilium; Acidobacteria; Proteobacteria; Ferroplasma; Desulfosporosinus; Organic matter; Archaea; Biology; Microbiology
Applied and Environmental Microbiology	Anoxic waters; Effluent; Iberian Pyrite Belt; Acidiphilium; Desulfosporosinus; Thermoplasmata; Geomicrobiology; Biochemistry; Botany; Biology; Microbiology; Extreme environment
Applied and Environmental Microbiology	Algal bloom; Water column; Bloom; Eutrophication; Ecology; Phototroph; Picocystis; Community; Microbial population biology; Biology; Microbiology
Applied and Environmental Microbiology	Anoxic waters; Substrate (chemistry); Intertidal zone; Ecology; Stable-isotope probing; Cyanobacteria; Sediment; Geologic Sediments; Biota; Biology
Applied and Environmental Microbiology	Relative species abundance; Methanosaeta; Methanogen; Methanosarcinales; Methanosarcina; Methanogenesis; 16S ribosomal RNA; Biology; Microbiology; Phylogenetics
Applied and Environmental Microbiology	Chemistry; Short-chain fatty acid; Desulfovibrio; Methylmercury; Methylation; 16S ribosomal RNA; Bacteria; Mercury (element); Biochemistry; Strain (chemistry)
Applied and Environmental Microbiology	Anoxic waters; Water column; Total organic carbon; Ecology; Seawater; Sediment; Geologic Sediments; Organic matter; Microbial population biology; Biology; Microbiology
Applied and Environmental Microbiology	Environmental chemistry; Community structure; Sulfate-reducing bacteria; Verrucomicrobia; Acidobacteria; Proteobacteria; Methylmercury; Mercury (element); Microbial population biology; Biology
Applied and Environmental Microbiology	Anaerobic oxidation of methane; Bioreactor; Sulfate-reducing bacteria; Desulfuromonadales; Methanogenesis; Sulfide; Methane; Bacteria; Biology; Microbiology
Applied and Environmental Microbiology	Environmental chemistry; Chemistry; Sulfate-reducing bacteria; Electron donor; Sulfate; Deltaproteobacteria; Ethanol; Sediment; Geologic Sediments; Biochemistry; Uranium
Applied and Environmental Microbiology	Nitrification; Thaumarchaeota; Proteobacteria; Nitrogen cycle; Archaea; Botany; Microbial ecology; Microbial population biology; Biology; Microbiology; Extreme environment
Biogeosciences	Autotroph; Geology; Bedrock; Metagenomics; Total organic carbon; Ecology; Sulfate-reducing bacteria; Comamonadaceae; Burkholderiales; Heterotroph

Source title	'Field of Study' as Index Keywords
Biogeosciences	Anaerobic oxidation of methane; Oceanography; Geology; Biogeochemistry; Ecology; Sulfate; Sulfide; Sediment; Petroleum seep; Biogeochemical cycle; Mud volcano
Biogeosciences	Pore water pressure; Anoxic waters; Water column; Geology; Ecology; Chemical oceanography; Sediment; Alkalinity; Oxygen saturation; Benthic zone
Biogeosciences	Anaerobic oxidation of methane; Authigenic; Geology; Or13C; Isotopes of carbon; Ecology; Carbonate; Methane; Subduction; Or18O
Biogeosciences	Anaerobic oxidation of methane; Water column; Geology; Ecology; Methanogen; Sulfate; Methanogenesis; Organic matter; Methane; Carbon cycle
Biogeosciences	Bog; Geology; Or13C; Total organic carbon; Ecology; Sphagnum; Isotope fractionation; Organic matter; Carbon dioxide; Peat
Biogeosciences	Anaerobic oxidation of methane; Ranging; Water column; Geology; Ecology; Sulfate; Methanogenesis; Sediment; Methane; Methane chimney
Biogeosciences	Anaerobic oxidation of methane; Geology; Hopanoids; Isotopes of carbon; Ecology; Phytane; Methane; Breccia; Sedimentary rock; Mud volcano
Biogeosciences	Authigenic; Geology; Diagenesis; Chemosynthesis; Coral; Geochemistry; Ecology; Diapir; Carbonate; Archaea; Mud volcano
Biogeosciences	Anoxic waters; Water column; Geology; Microorganism; Ecology; Archaeol; Cyanobacteria; Bacteria; Archaea; Biogeochemical cycle

Remark: The name of file in collection of full data: Lens_1080_top 19 Source Title - Field of Study.csv

Table 6. Top 30 'Field of Study' as Index Keywords for 'Source Title (top 19 by number of publications)' using 1080 scholarly dataset from Lens.org DB

'Field of Study' as Index Keywords	occurrences	total link strength
ecology	333	2736
biology	327	2667
sulfate	119	1030
geology	94	767
sediment	86	712
microbial population biology	83	726
sulfate-reducing bacteria	83	717
chemistry	80	663
microbiology	73	644
environmental chemistry	72	638
archaea	71	625
bacteria	67	566
botany	58	518
anoxic waters	56	484
sulfur	56	490
anaerobic oxidation of methane	49	434
biogeochemical cycle	48	419
geochemistry	46	393
sulfide	46	400
methane	45	368

'Field of Study' as Index Keywords	occurrences	total link strength
organic matter	40	347
inorganic chemistry	39	319
methanogenesis	38	319
total organic carbon	35	305
deltaproteobacteria	34	312
microorganism	34	275
environmental engineering	33	264
ecosystem	29	231
firmicutes	28	247
microbial mat	28	245

Remark: The name of file in collection of full data: Lens _1080 _top 19 Source Title - Field of Study KW VOSviewer.tsv

The name of image file in collection build by VOSviewer: Lens_1080_top 19 Source Title - Field of Study KW VOSviewer.png

Table 7. Top 30 data. 'Fields of Study 2010-2014' vs 'Fields of Study 2015-2019' using 1080 scholarly dataset from Lens.org DB

Fields of Study 2010-2014	N	Fields of Study 2015-2019	N
Biology	249	Biology	248
Ecology	241	Ecology	231
Geology	132	Geology	155
Sulfate	107	Chemistry	117
Chemistry	94	Environmental chemistry	103
Sulfate-reducing bacteria	85	Sulfate	101
Sediment	80	Sediment	89
Bacteria	67	Sulfate-reducing bacteria	80
Environmental chemistry	65	Geochemistry	70
Geochemistry	64	Microbial population biology	69
Archaea	61	Microbiology	65
Microbial population biology	58	Bacteria	64
Microbiology	53	Sulfur	64
Sulfur	49	Anoxic waters	49
Botany	48	Organic matter	49
Methane	47	Geomorphology	47
Biogeochemical cycle	45	Sulfide	45
Anaerobic oxidation of methane	44	Archaea	42
Anoxic waters	43	Methane	42
Sulfide	40	Anaerobic oxidation of methane	41
Inorganic chemistry	39	Botany	41
Carbonate	38	Paleontology	40
Mineralogy	38	Methanogenesis	37
Geomorphology	37	Biogeochemical cycle	36

Fields of Study 2010-2014	N	Fields of Study 2015-2019	N
Environmental engineering	34	Inorganic chemistry	36
Microorganism	33	Biochemistry	35
Biochemistry	31	Environmental engineering	34
Groundwater	31	Pyrite	34
Organic matter	31	Groundwater	33
Total organic carbon	29	Microorganism	31

Remark: The name of file in collection of full data: Lens-1080-Fields of Study-2010-2014-vs-2015-2019-count-top-100.csv

Fields of Study didn't significantly different between 2010-2014 and 2015-2019

Table 8. Top 10 data. Most Active Authors using 1080 scholarly dataset from Lens.org DB

Author ID	Document Count
Andreas Teske (1690131773)	14
Antje Boetius (1272140054)	14
Bo Barker Jørgensen (2098910190)	10
Daniel Birgel (2427046885)	10
Katrin Knittel (2064030120)	9
Fumio Inagaki (1757246265)	8
Hilke Wurdemann (2031072929)	8
Alban Ramette (293186974)	7
Alexandra V Turchyn (2508317456)	7
Alfons J M Stams (2423207224)	7

Remark: The name of file in collection of full data: Lens-1080-Most Active Authors data.csv

Table 9. Top 24 data. Most Active Countries using 1080 scholarly dataset from Lens.org DB

Institution Country/Region	Document Count
United States	338
Germany	134
China	129
United Kingdom	103
France	60
Canada	58
Australia	51
Japan	50
Spain	49
Netherlands	44
Switzerland	38
Denmark	34
Brazil	20
Norway	19
Poland	18

Institution Country/Region	Document Count
Austria	17
India	17
Korea, Republic of	17
Sweden	17
Italy	15
Finland	13
Portugal	13
Israel	11
Russia	11

Remark: The name of file in collection of full data: Lens-1080-Most active CountriesRegions data.csv

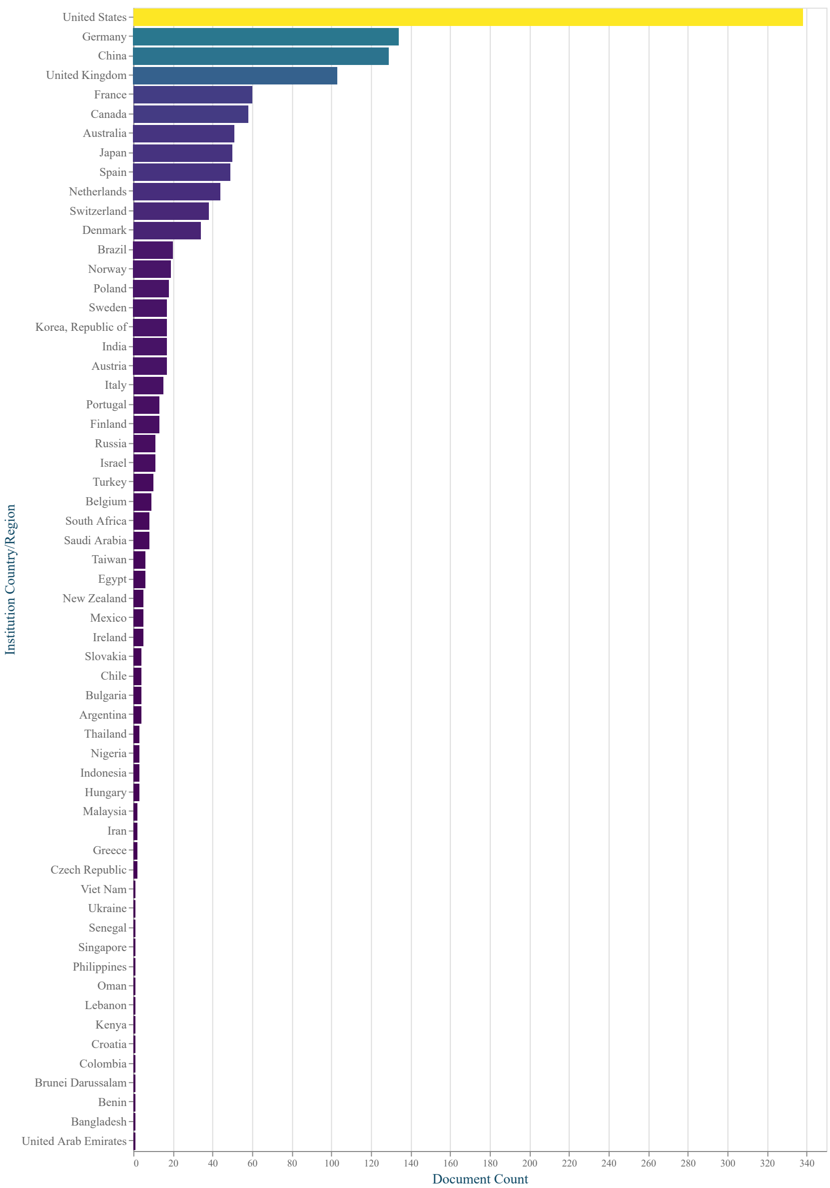


Figure 1. Most Active Countries using 1080 scholarly dataset from Lens.org DB

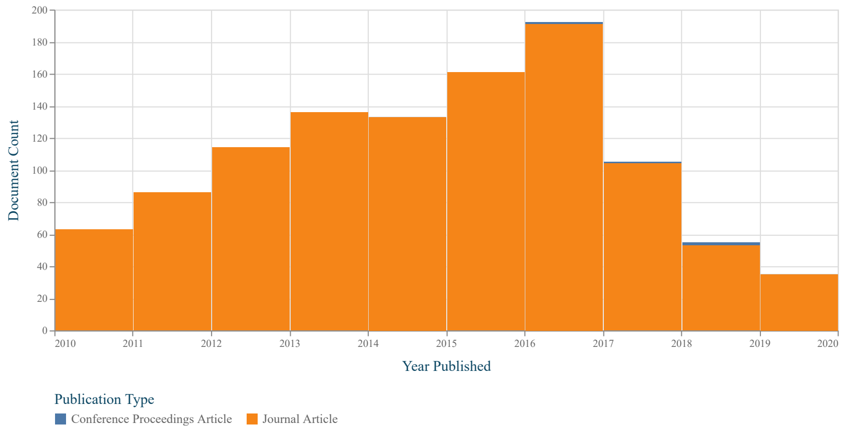


Figure 2. Most Scholarly Works over time using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of full data: [Lens-1080-Scholarly Works over time data.csv]

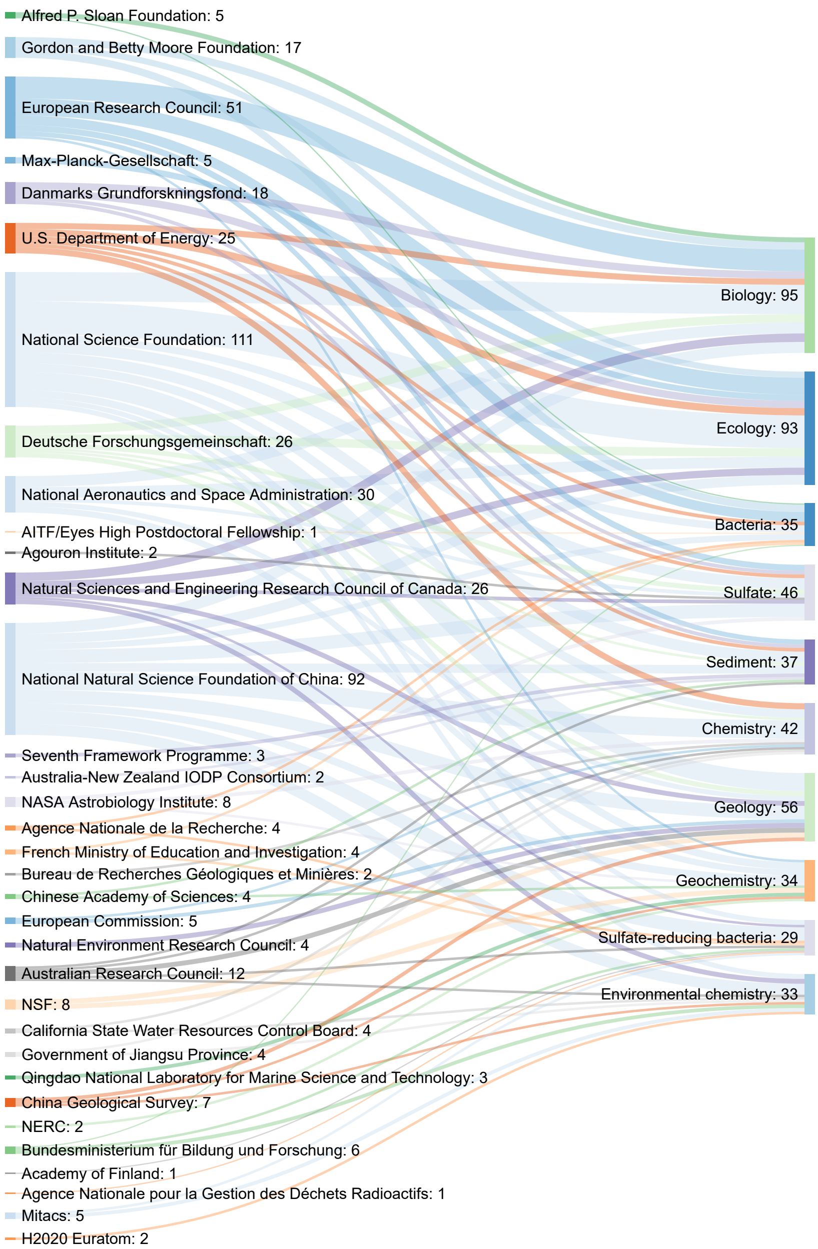


Figure 3. Sankey Diagram 'Field of Study' -> 'Funding' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: [Lens-1080-SunKey-Field of Study Funding by Doc Count data.csv]

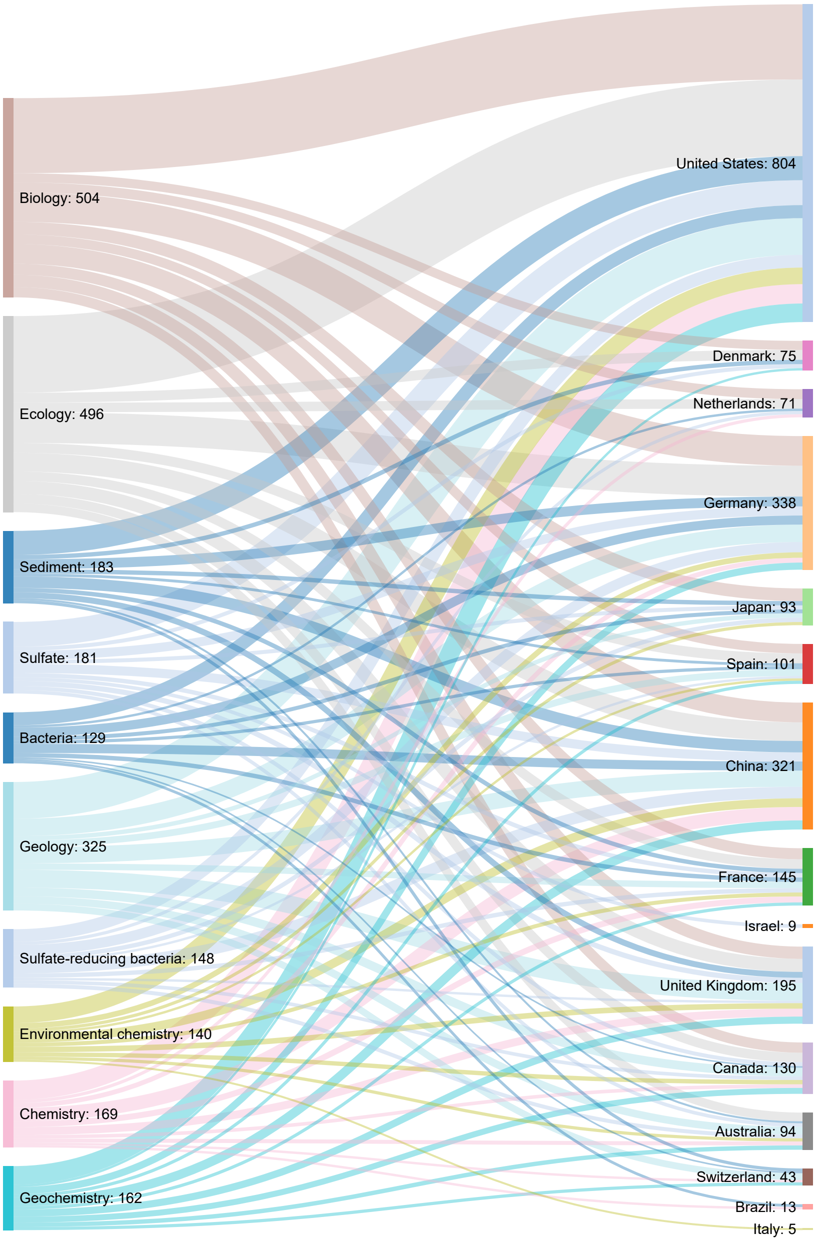


Figure 4. Sankey Diagram 'Field of Study' -> 'Institution Country ' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: Lens-1080-SunKey-Field of Study Institution Country by Doc Count data.csv

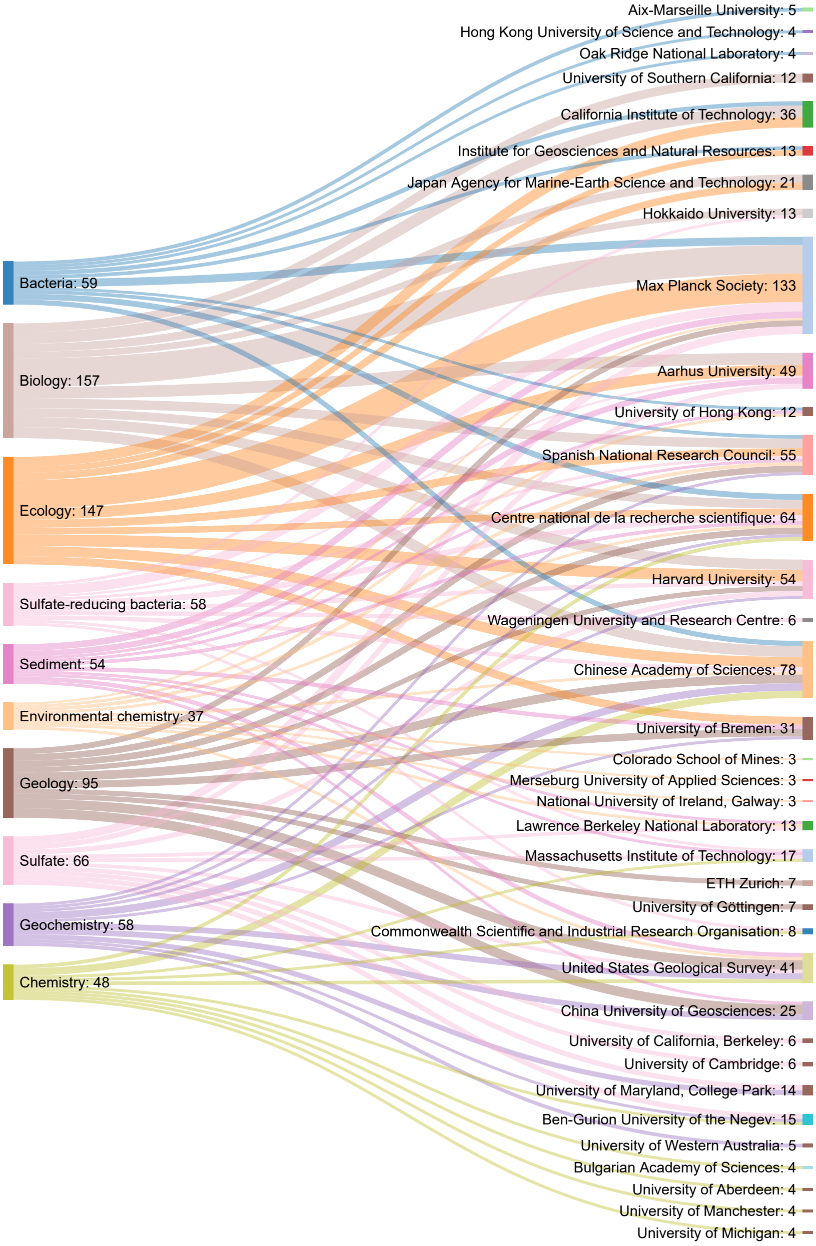


Figure 5. Sankey Diagram 'Field of Study' -> 'Institution Country ' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: [Lens-1080-SunKey-Field of Study Institution Name by Doc Count 10x10 data.csv]()

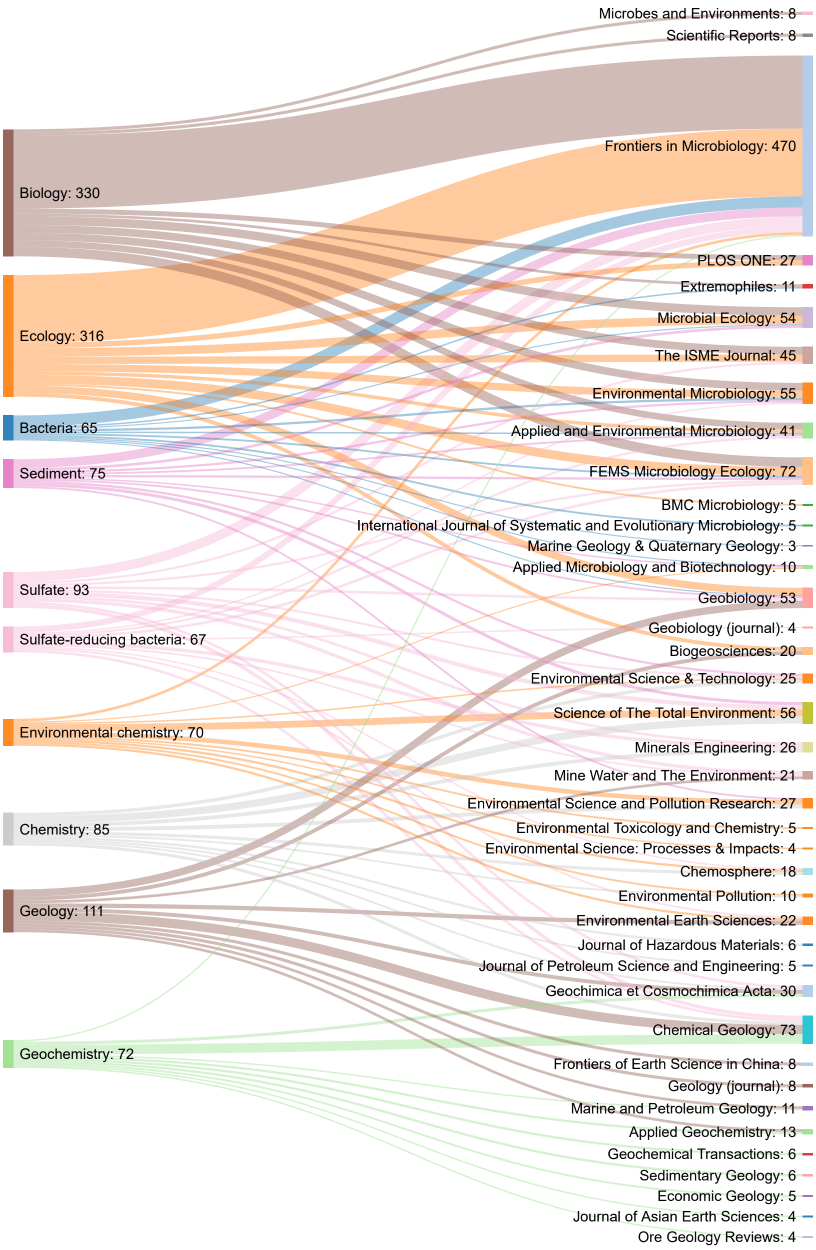


Figure 6. Sankey Diagram 'Field of Study' -> 'Source Title' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: [Lens-1080-SunKey-Field of Study Source Title by Doc Count data.csv]

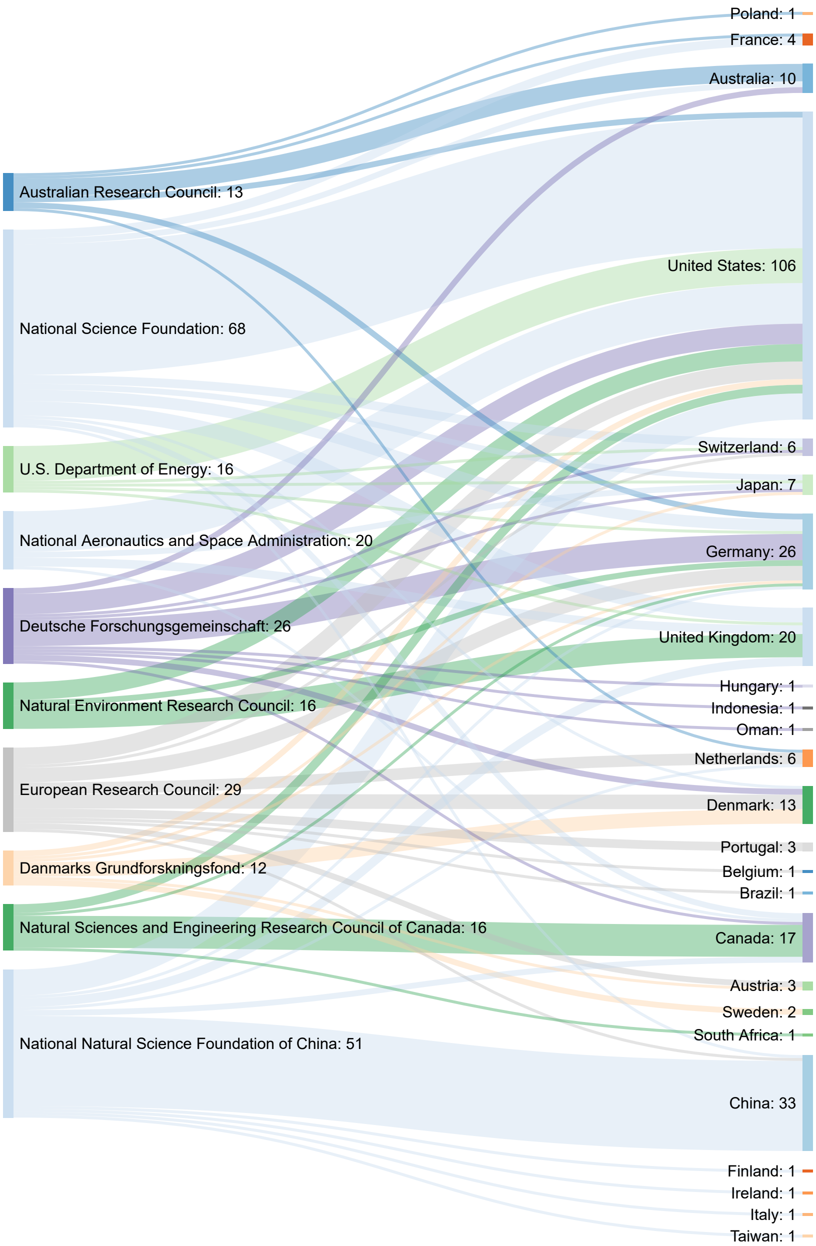


Figure 7. Sankey Diagram 'Funding' -> 'Institution Country' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: [Lens-1080-SunKey-Funding Institution Country by Doc Count 10x10 data.csv]()

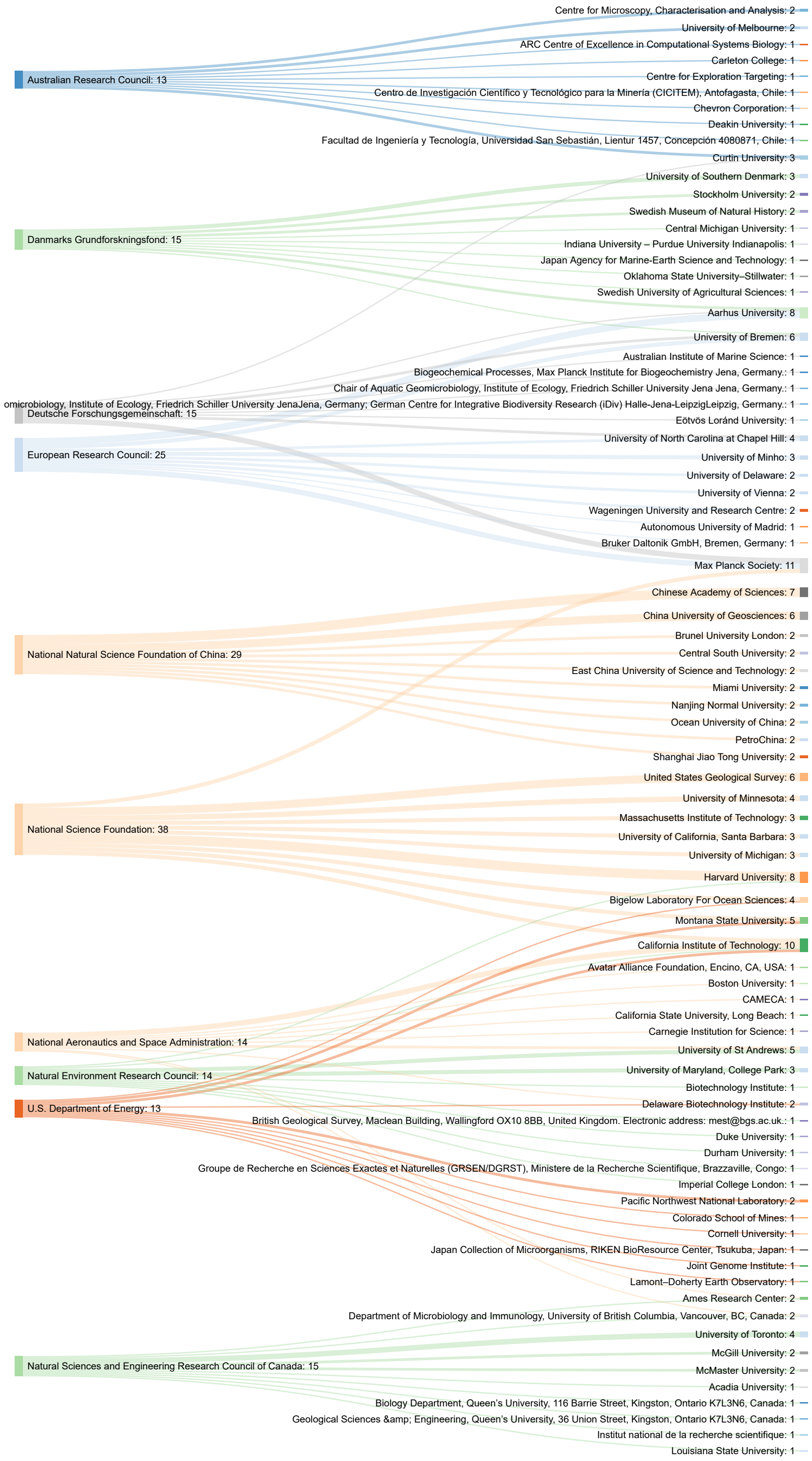


Figure 8. Sankey Diagram 'Funding' -> 'Institution Name' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: [Lens-1080-SunKey-Funding Institution Name by Doc Count 10x10 data.csv]()

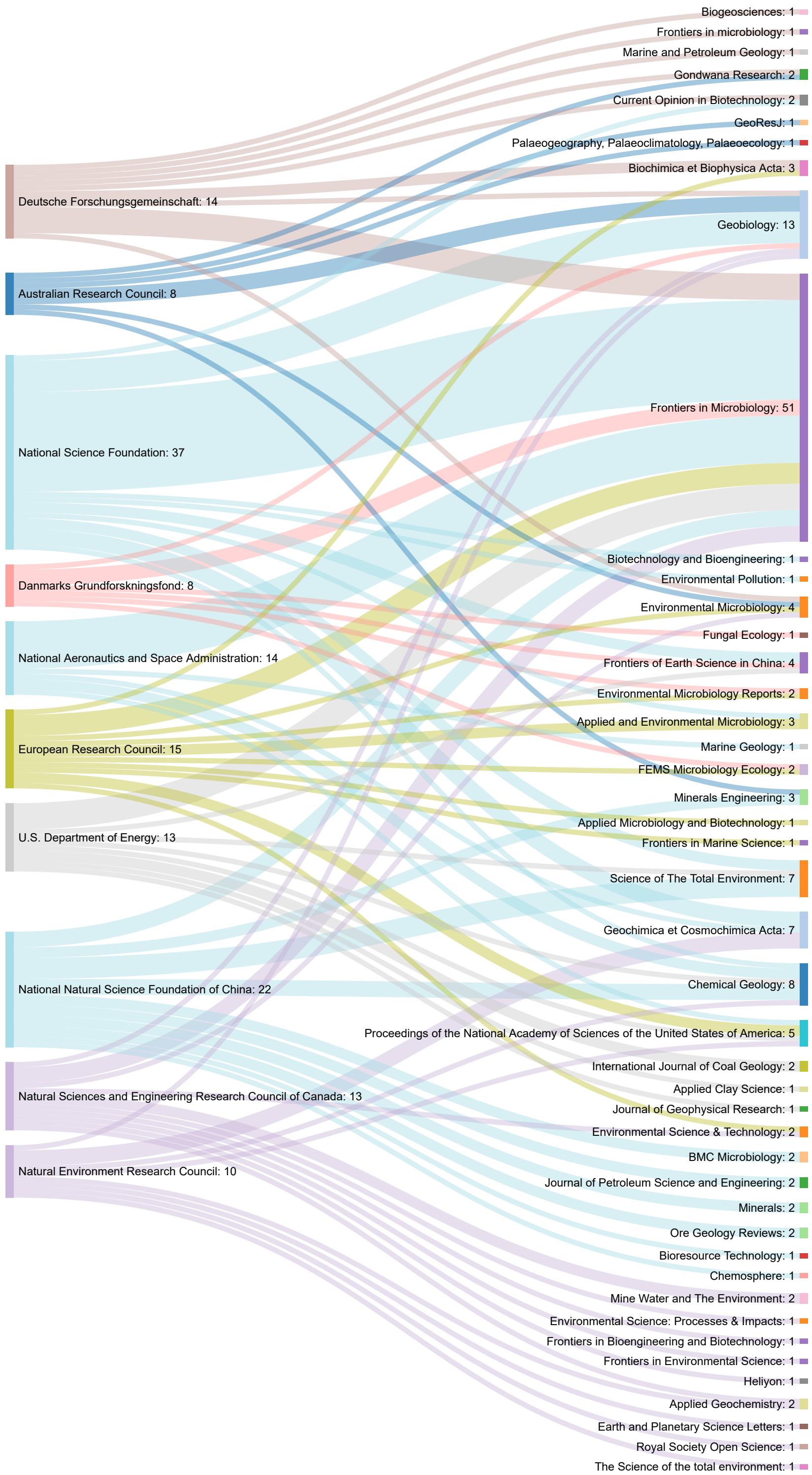


Figure 9. Sankey Diagram 'Funding' -> 'Institution Name' by Doc Count using 1080 scholarly dataset from Lens.org DB

Remark: The name of file in collection of data: [Lens-1080-SunKey-Funding Source Title by Doc Count 10x10 data.csv]()

Scopus

Main items:

- compare KW (or key phrases) in 2010-2014 and 2015-2019
- compare index KW by Scopus and key terms by TermExtract

Query: TITLE-ABS-KEY ((sulfate-reducing) AND geolog*) AND PUBYEAR > 2009; **539** document results

Table 10. Top 50 key terms. 2010-2014 vs 2015-2019. Corpus as concatenation of "Title", "Abstract" and index KW from Scopus bibliometric data.

Using KH Coder 3 TermExtract to get key terms and there score

KW 2010-2014	Score	KW 2015-2019	Score
microbial community	19977.144	microbial community	27867.433
bacteria microorganisms	10095.195	sulfate reduction	12555.792
sulfate reduction	9718.068	microbial activity	10281.586
geologic sediments	9688.569	geologic sediments	9334.024
sulfate-reducing bacteria	8012.535	**water pollutant**	7169.360
microbial activity	7346.257	bacteria microorganisms	6918.431
marine sediment	7250.710	microbial communities	5854.883
sequence analysis	6546.510	***sulfur compounds***	5718.542
marine sediments	4873.548	oxidation reduction reaction	5557.371
microbial communities	4703.632	marine sediments	5175.272
organic carbon	4697.648	organic carbon	5174.680
oxidation reduction reaction	4312.454	marine sediment	4970.859
organic matter	3856.174	sulfate-reducing bacteria	4964.185
dna sequence	3379.267	organic matter	4839.810
bacterial dna	3377.044	microbial diversity	4470.272
bacterial community	2997.776	bacteria srb	3880.877
gene sequence	2760.924	**sea water**	2984.071
sea water	2574.903	microbial sulfate reduction	2829.127
molecular sequence data	2490.330	bacterial sulfate reduction	2627.047
microbial sulfate reduction	2361.964	water column	2526.711
anoxic sediments	2087.720	sequence analysis	2415.973
microbial diversity	2005.299	bacterial dna	2294.530
water pollutants	1860.786	community structure	2237.715
sulfate-reducing bacteria srb	1830.489	sulfur isotope	2146.611
bacteria srb	1817.006	**water pollutants**	2118.381
polymerase chain reaction	1771.228	sulfate-reducing bacteria srb	2054.326
community structure	1673.081	anaerobic growth	1857.022
anaerobic oxidation of methane	1625.356	sediment pollution	1846.179
concentration composition	1496.137	bacterial community	1814.490
nucleotide sequence	1488.710	dna sequence	1650.036
sulfur isotope	1488.118	hydrogen sulfide	1630.322
sediment pollution	1484.426	negative anaerobic bacteria	1579.475
sulfur-reducing bacteria	1399.988	bacterial gene	1398.483
sulfur compounds	**1373.922**	concentration composition	1336.936
cluster analysis	1326.434	microbial community composition	1304.930
carbon isotope	1283.077	**ground water**	1271.323
16s rrna gene	1271.912	sulfate concentrations	1264.600
sediment chemistry	1270.599	**formation water**	1264.305

KW 2010-2014	Score	KW 2015-2019	Score
bacterial gene	1270.066	environmental monitoring	1263.535
bacterial sulfate reduction	1256.478	bacterial communities	1249.555
microbial community composition	1254.672	bacterial community structure	1242.731
fatty acid	1254.492	bacterial diversity	1237.686
sediment analysis	1247.659	**water quality**	1214.494
microbial activities	1190.089	surface sediments	1203.445
anoxic conditions	1172.230	total organic carbon	1188.517
negative anaerobic bacteria	1143.536	coastal sediment	1156.558
water pollutant	1140.514	**fresh water**	1088.342
microbial mat	1120.384	microbial consortium	1082.998
water pollution	1104.615	microbial consortia	1035.369
anaerobic growth	1104.581	sulphate-reducing bacteria	1034.809

Remark: 2010-2014 ***sulfur compounds*** score **1373.**922 vs 2015-2019 ***sulfur compounds*** score **5718**.542. The item to further study: does increase attention to sulfur compounds concern to water pollution?

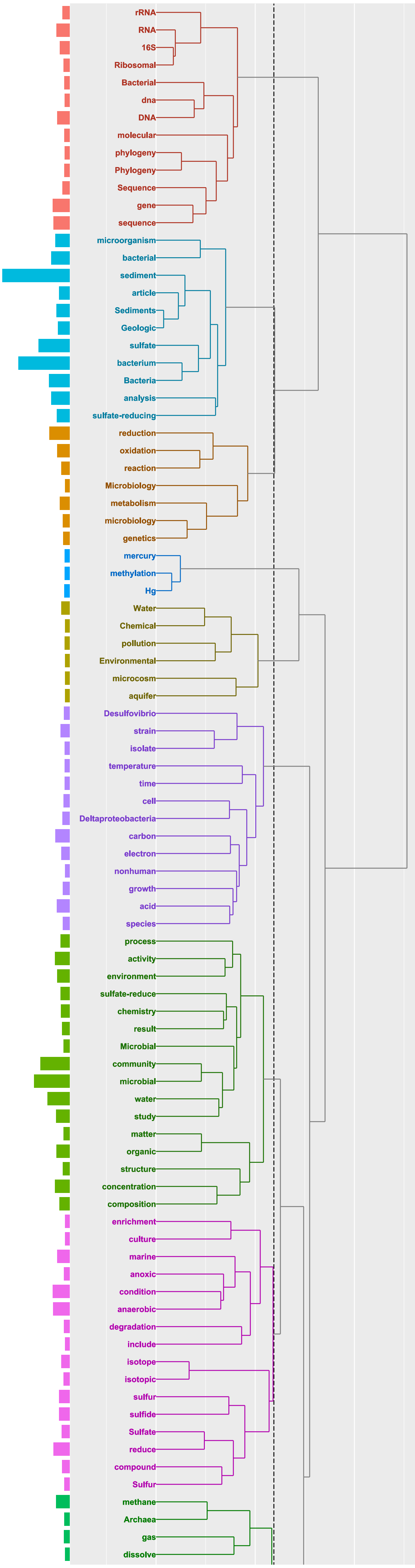
The names of files in collection with data: Scopus_539-CONCAT_title-abstrect-indexKW-2010-2014 TermExtract.csv ; Scopus_539-CONCAT_title-abstrect-indexKW-2015-2019 TermExtract.csv

Table 11. Top 57 index KW from Scopus bibliometric data

2010-2014 index KW	N	2015-2019 index KW	N
Geologic Sediments	171	sediment	350
article	159	Geologic Sediments	329
sediment	151	Bacteria	282
Bacteria	139	sulfate	246
Bacteria (microorganisms)	123	microbiology	240
sulfate	118	metabolism	215
microbiology	102	Bacteria (microorganisms)	194
metabolism	94	bacterium	172
microbial community	82	microbial community	169
Phylogeny	81	article	159
Deltaproteobacteria	79	sulfate-reducing bacterium	158
nonhuman	76	RNA 16S	152
sulfate-reducing bacterium	74	nonhuman	151
bacterium	72	genetics	149
RNA, Ribosomal, 16S	71	chemistry	148
phylogeny	69	Phylogeny	134
genetics	68	RNA, Ribosomal, 16S	133
RNA 16S	67	Deltaproteobacteria	131
Archaea	66	Sulfates	127
Sulfates	65	Oxidation-Reduction	126
Oxidation-Reduction	64	***Sulfur compounds***	125
chemistry	56	phylogeny	125
Molecular Sequence Data	55	oxidation reduction reaction	115

2010-2014 index KW	N	2015-2019 index KW	N
classification	54	classification	112
Sulfate reducing bacteria	53	Sulfate reducing bacteria	110
methane	50	Archaea	109
oxidation reduction reaction	50	methane	100
Sedimentology	49	microbial activity	100
nucleotide sequence	49	Article	97
Methane	48	China	88
microbial activity	48	isolation and purification	87
DNA, Bacterial	47	Methane	86
Water Pollutants, Chemical	44	**water pollutant**	86
sulfate reducing bacterium	44	Sediments	85
priority journal	43	**Water Pollutants, Chemical**	85
Sequence Analysis, DNA	41	sulfate reducing bacterium	85
Seawater	38	priority journal	79
isolation and purification	37	bioremediation	77
bacterial DNA	35	controlled study	75
Ecosystem	34	sulfide	75
Sulfur	34	DNA, Bacterial	72
controlled study	34	Sulfur	70
Desulfovibrio	33	nucleotide sequence	67
oxidation	33	oxidation	67
United States	32	Molecular Sequence Data	66
anoxic conditions	32	Sequence Analysis, DNA	64
Anaerobiosis	31	Biodegradation, Environmental	63
Sulfur-Reducing Bacteria	31	bacterial DNA	63
molecular genetics	31	Groundwater	62
Biodegradation, Environmental	30	Anaerobiosis	59
Biodiversity	29	Desulfovibrio	59
concentration (composition)	29	Seawater	59
DNA sequence	28	concentration (composition)	59
sulfide	28	Biodiversity	55
Anoxic sediments	27	reduction	55
Submarine geology	27	Sedimentology	54
Sulfur compounds	27	anoxic conditions	54

Remark: The name of file in collection of data: Scopus_539-indexKW-count-2010-2014_vs_2015-2019_top-100.csv


rRNA
RNA
16S
Ribosomal
Bacterial
dna
DNA
molecular
phylogeny
Phylogeny
Sequence
gene
sequence
microorganism
bacterial
sediment
article
Sediments
Geologic
sulfate
bacterium
Bacteria
analysis
sulfate-reducing
reduction
oxidation
reaction
Microbiology
metabolism
microbiology
genetics
mercury
methylation
Hg
Water
Chemical
pollution
Environmental
microcosm
aquifer
Desulfovibrio
strain
isolate
temperature
time
cell
Deltaproteobacteria
carbon
electron
nonhuman
growth
acid
species
process
activity
environment
sulfate-reduce
chemistry
result
Microbial
community
microbial
water
study
matter
organic
structure
concentration
composition
enrichment
culture
marine
anoxic
condition
anaerobic
degradation
include
isotope
isotopic
sulfur
sulfide
Sulfate
reduce
compound
Sulfur
methane
Archaea
gas
dissolve

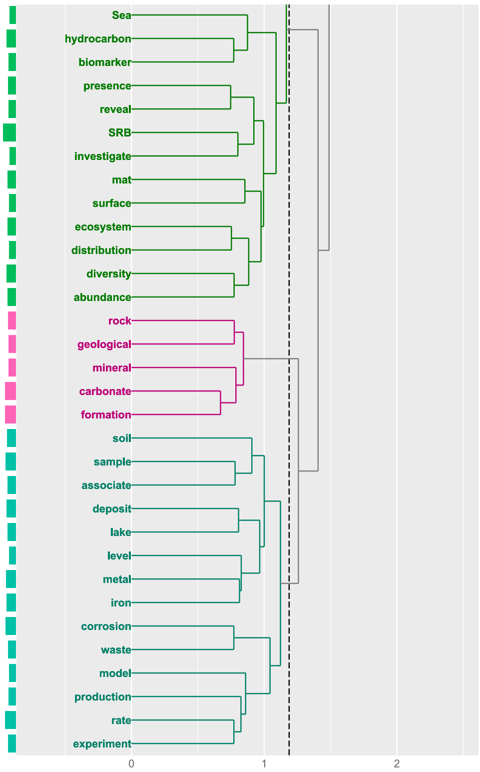
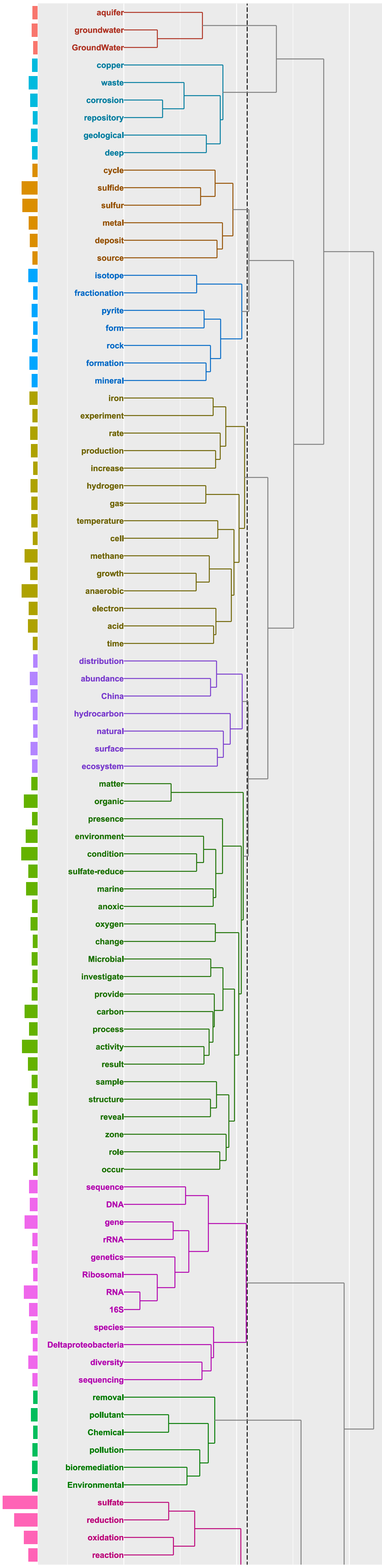


Figure 10. The dendrogram is built by using KH Coder 3 and based on data in the file: [Scopus_539-CONCAT_title-abstrect-indexKW-2010-2014 TermExtract.csv]


aquifer
groundwater
GroundWater
copper
waste
corrosion
repository
geological
deep
cycle
sulfide
sulfur
metal
deposit
source
isotope
fractionation
pyrite
form
rock
formation
mineral
iron
experiment
rate
production
increase
hydrogen
gas
temperature
cell
methane
growth
anaerobic
electron
acid
time
distribution
abundance
China
hydrocarbon
natural
surface
ecosystem
matter
organic
presence
environment
condition
sulfate-reduce
marine
anoxic
oxygen
change
Microbial
investigate
provide
carbon
process
activity
result
sample
structure
reveal
zone
role
occur
sequence
DNA
gene
rRNA
genetics
Ribosomal
RNA
16S
species
Deltaproteobacteria
diversity
sequencing
removal
pollutant
Chemical
pollution
bioremediation
Environmental
sulfate
reduction
oxidation
reaction

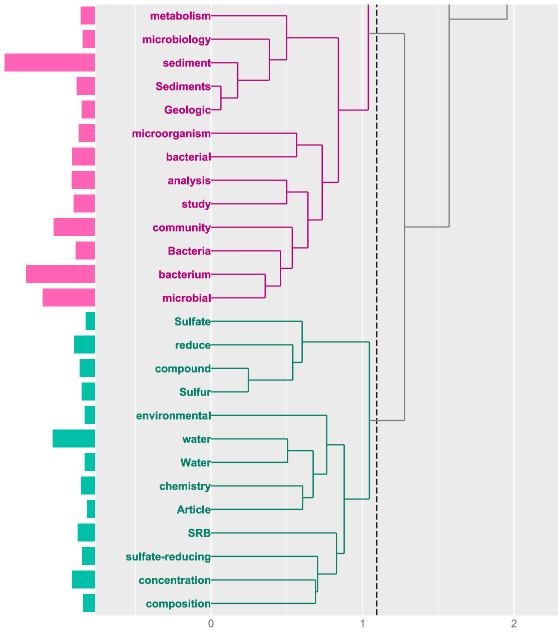


Figure 11. The dendrogram is built by using KH Coder 3 and based on data in the file: Scopus_539-CONCAT_title-abstrect-indexKW-2015-2019 TermExtract.csv

Table 12. Top 50 key terms. 2010-2014 vs 2015-2019. Adding filter: "sulfur compounds", results by TermExtract .

KW 2010-2014	Score	KW 2015-2019	Score
sulfur isotope	1488.118	sulfur compounds	5718.542
sulfur-reducing bacteria	1399.988	sulfur isotope	2146.611
sulfur compounds	1373.922	sulfur cycle	1013.972
sulfur cycle	501.950	sulfur-reducing bacteria	791.350
organic compounds	423.397	sulfur cycling	687.384
mercury compounds	396.657	sulfur isotope fractionation	570.988
methylmercury compounds	335.263	organic compounds	389.071
iron compounds	334.559	iron compounds	382.082
elemental sulfur	195.416	sulfur reduction	367.459
sulfur isotopes	173.460	sulfur oxidation	268.097
sulfur isotope data	172.322	sulfur isotopes	256.151
sulfur cycling	161.954	native sulfur	231.653
sulfur reduction	131.857	methylmercury compounds	219.690
organic sulfur compounds	122.126	sulfur bacteria	196.138
sulfur cycles	111.479	sulfur-oxidizing bacteria	169.140
sulfur-oxidizing bacteria	109.773	sulfur isotope compositions	163.214
sulfur isotope signatures	89.032	elemental sulfur	149.829
organic sulfur compound	87.183	microbial sulfur isotope fractionation microbial sulfate reduction	144.763
desulfovibrio desulfuricans	70.845	anaerobic sulfur	137.715
sulfur dioxide	63.988	large sulfur isotope fractionation	130.334
microbial sulfur metabolism	62.233	magnitude of sulfur isotope fractionation	117.538
sulfur isotope fractionation	54.495	mercury compounds	104.810
aerobic oxidation of sulfur	53.257	sulfur isotope analysis	104.048

KW 2010-2014	Score	KW 2015-2019	Score
green sulfur bacteria	51.198	microbial sulfur cycling	102.975
fractionation of sulfur isotopes	50.012	sulfur isotope signatures	93.091
sulfur isotope evidence	46.552	sulfur cycling community	92.007
filamentous sulfur bacteria	44.726	sulfur fluxes	78.165
total sulfur	42.560	sulfur isotope composition	78.149
sulfur nutrient concentrations	41.526	reduced sulfur species	77.882
negative sulfur isotope values	41.244	sulfur derivative	69.665
marine desulfovibrio sp sulfur isotope effects	38.712	source of sulfur	67.241
stable sulfur isotope fractionation	38.492	sedimentary sulfur	66.756
ferric compounds	37.986	sulfur precipitation	66.450
abundant organic sulfur compounds	35.965	large native sulfur deposits	62.852
inorganic sulfur	34.380	spatio-temporal dynamics of sulfur bacteria	62.569
composition of sulfur isotopes	33.421	anaerobic sulfur cycle	60.475
large sulfur isotope fractionation	33.319	high sulfur isotope fractionation	58.573
sulfur deposits	33.143	sulfur-oxidizing bacterial community	56.157
microbial sulfur disproportionation	32.877	acidophilic sulfur reduction	55.977
stable sulfur isotope results	32.745	uranium compounds	54.589
sulfur isotope fractionations	32.237	native sulfur deposits	53.982
isotopic light sulfur	32.030	multiple sulfur	51.638
hg compounds	31.931	sulfur isotope record	51.336
sulfur sources	31.066	sulfur compound	50.812
biogeochemical cycling of sulfur	30.669	biological sulfur cycling	49.596
associated sulfur isotope fractionation	30.420	ferric compounds	47.556
sulfur determination	30.334	inorganic compounds	45.892
compounds of oil	30.163	sulfur isotope distributions	45.735
sulfur isotope records	29.031	purple sulfur bacteria psb	45.675
large filamentous sulfur bacteria	28.731	native sulfur formation	45.624

Remark: The names of files in collection of data: Scopus_539-CONCAT_title-abstrect-indexKW-2010-2014 TermExtract-Sulfur compounds.csv Scopus_539-CONCAT_title-abstrect-indexKW-2015-2019 TermExtract-Sulfur compounds.csv

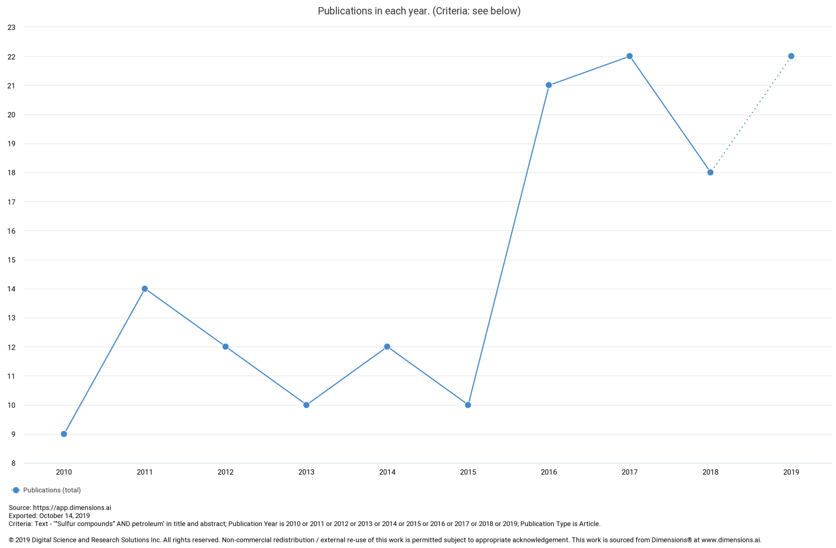


Figure 12. The number of publications in each year. Data from query ("sulfur compounds" AND petroleum) in **dimansions.ai DB**

Remark: according to data from dimensions.ai here is the intermittent increase of usage of term "sulfur compounds" after 2015

It is in coincidence with the results in: Scopus-539-KW-co-occurr-730kw-5thr-Overlay.png , **Figure 14.**, **Tables 10 and 11**

OnePetro

Item: to study context for **"sulfur compounds"** by **AntConc** as concordance builder using OnePetro as domain-specific bibliometric DB

Main query: "sulfur compounds". The aim of this study: in witch contexts the term **sulfur compounds** meet in OnePetro publications.

Comparison 2010-2014 and 2015-2019 contexts for **sulfur compounds**. Using **AntConc** to build concordance

Table 13. Concordance for **sulfur compounds** based on titles and abstracts of bibliometric data 2010-2014 from OnePetro

N	before sulfur compounds	after sulfur compounds
1	Fe2O3) and cementite (Fe3C), with little to no indication of any presence of sulfur or	sulfur compounds. A sample of the gas from within the outlet header of the WHRU was also collected
2	Analysis of Corrosion Scales Formed on Steel at High Temperatures in Hydrocarbons Containing Model Naphthenic Acids and	Sulfur Compounds Corrosive naphthenic acids and sulfur compounds in crude oils present a major challenge for refineries from
3	uenced corrosion was significant. The electron microscope analysis showed that, corrosion products were mainly iron and	sulfur compounds, and calcium carbonate. The influence of SRB on corrosion was obtained by experiment between SRB numbers
4	reactor where major fraction of feed metals are removed by catalytic hydro-demetalization and 40% to 50% of the	sulfur compounds are converted to H2S via catalytic hydro-desulfurization. The mixture then flows to the fixed
5	2S via catalytic hydro-desulfurization. The mixture then flows to the fixed bed reactors where more difficult	sulfur compounds are converted to H2S and some of the remaining feed metals are converted to metal

N	before sulfur compounds	after sulfur compounds
6	Scale of Pipeline Steel Under High H_2S/CO_2 Partial Pressure ABSTRACT:Corrosion scale composed of iron-	sulfur compounds can significantly affect the corrosion process. However, the transition of different crystals along with time and
7	corrosion is the main type encountered in H_2S/CO_2 environments, and corrosion scale composed of iron-	sulfur compounds can significantly affect the corrosion process 1~5. Several studies have shown that the corrosion products could be
8	re present due to various chemical mechanisms such as: thermochemical sulfate reduction, thermal degradation of organic	sulfur compounds, dissolution of pyritic materials and redox reactions with bisulfite oxygen scavengers3. Sulfur can also be formed
9	the sulfur distribution in the crude. A considerable amount of mercaptans results from the decomposition of other	sulfur compounds during crude distillation and cracking operations. The lower boiling mercaptans have extremely agressive odour and must
10	, on the other hand, create a reducing atmosphere in the boiler due to the lack of oxygen.	Sulfur compounds from the coal are transformed into highly corrosive gaseous H_2S [4]. Subsequent reaction with the metal
11	anied by contaminants such as benzene, toluene, xylenes (collectively called BTX), other hydrocarbons, NH_3, CO_2, N_2 and	sulfur compounds having detrimental effect on catalytic reactors, where BTX form soot particles and sulfur-hydrocarbons, and clog
12	, BTX are the major concern for the sulfur recovery unit operators as they form soot or carbon-	sulfur compounds in catalytic units that clog and deactivate the catalysts, and lead to the production of off-
13	oils, as well as the CO_2/H_2S ratio of the gas phase." "Determining the Behavior of	Sulfur Compounds in Controlling Preferential Weld Corrosion in CO_2- saturated Brine ABSTRACTThis paper presents the application of white
14	peratures in Hydrocarbons Containing Model Naphthenic Acids and Sulfur Compounds ABSTRACTCorrosive naphthenic acids and	sulfur compounds in crude oils present a major challenge for refineries from a corrosion perspective. Although it is
15	n Corrosion TheorySulfidation corrosion theory, also known as sulfidic corrosion, is the corrosion of metal surfaces by	sulfur compounds in liquid hydrocarbon is known to increase with both increasing temperature, and sulfur content. The corrosion
16	the major reason that resulted in the scaling substance was the corrosion of the container by the	sulfur compounds in the chemical material of the cracking unit. Introduce The E252 heat exchanger of 20 million tons
17	the major reason that resulted in the scaling substance was the corrosion of the container by the	sulfur compounds in the chemical material of the cracking unit. The paper could provide the experience for the
18	are sequestered to some extent in the reservoir. Also water usage is lowered and heavy metals and	sulfur compounds in the bitumen tend to remain downhole. The overall objective of this research is to understand
19	ation can also shift the microbial community toward autotrophic sulfide-oxidizing bacteria capable of oxidizing reduced	sulfur compounds. Jenneman et al. reported the ability of nitrate to stimulate the activity of indigenous, anaerobic SOB

N	before sulfur compounds	after sulfur compounds
20	oils present a major challenge for refineries from a corrosion perspective. Although it is accepted that some	sulfur compounds may form protective FeS scales on the metal surface and deter corrosion, attempting to correlate the
21	air. These sulfur emissions come typically in the form of sulfur dioxide (SO2), created by burning the	sulfur compounds naturally existing in oil and gas deposits. Air emissions of SO2 are a primary cause of
22	near equilibrium. This applies not only to minerals and formation waters, but also to hydrocarbons and organic	sulfur compounds (OSC) in crude oils and condensates. The metastable equilibrium approach pioneered by Helgeson et al. (1993) is
23	near equilibrium. This applies not only to minerals and formation waters, but also to hydrocarbons and organic	sulfur compounds (OSC) in crude oils and condensates. The metastable equilibrium approach pioneered by Helgeson et al. (1993) is
24	pilot and operational test-runs. The HySWEET®MDEA process is under development, for the selective elimination of	sulfur compounds over CO2. Improved mercaptan removal and high energy efficiency have been demonstrated during pilot tests. These
25	pH of the production water for the recovery of iodine. The original production water did not contain	sulfur compounds. The addition of H2SO4 was thought to be promoting the SRB activity in the plant
26	(FMT) of the deposit is exceeded, and more so if the molten deposit contains sulfide or reduced	sulfur compounds2-8. The practice of maintaining tube temperatures below the first melting point of the deposits has permitted
27	correlate well with corrosivity. A fundamental study of the relationships of molecular structures of organic acid and	sulfur compounds to corrosivity has been performed in a test unit that simulates corrosion found under vacuum distillation
28	) dissolved in white oil (Klearol(2)) having a boiling point range of 225 to 520°C. The organic acids and	sulfur compounds used for preparing model mixtures in white oil were purchased from a commercial chemical company." "Controlling

Remark: The file name in the collection of data on Figshare.com: OnePetro_Sulfur compounds CONCAT title abstract 2010-2014-antconc_results.tsv

Table 14. Concordance for **sulfur compounds** based on titles and abstracts of bibliometric data 2015-2019 from OnePetro

N	before sulfur compounds	after sulfur compounds
1	effects of naphthenic acids (NAP) occur in the same temperature range as sulfidation corrosion due to reactive	sulfur compounds also contained in crude oils. Efforts of mitigating NAP corrosion of existing equipment by a high
2	ide or mercaptan emissions standards. There are several chemistries available for treating hydrocarbon feeds containing	sulfur compounds and acidic components like hydrogen sulfide and mercaptans. The early processes included treatment of the hydrocarbon
3	gher potential for corrosion damage. Mitigating this corrosion involves several strategies: 8-10" "Corrosivity Study of	Sulfur Compounds and Naphthenic Acids under Refinery Conditions AbstractThe potential corrosivity of crude oils is a major concern
4	: As the temperature of the asphalt sample increases, HS changes to a vapor phase via degradation of	sulfur compounds, and the mixing and contact time are critical to HS scavenger performance. These finding corroborate those

N	before sulfur compounds	after sulfur compounds
5	influence of crude oil chemistry on naphthenic acid corrosion, the protectiveness of the iron sulfide scale with	sulfur compounds, and the ability to resist naphthenic acid corrosion with sulfur speciation including molecular weight, molecular struc
6	of several factors including the balance of hydrocarbon to steam, incorporation of process gas dopants (e.g.	sulfur compounds), and the surface chemistry of the materials6 that make up the reactor. Understanding the relation between
7	pplication due to volatilization and depletion mechanisms. When exposed to aggressive species such as carbon compounds,	sulfur compounds, and water vapor, the chromia layer can be stripped leaving the alloy susceptible to carburization and
8	novel method which enables sour natural gas to be directly burned for power generation without pretreatment. Oxidized	sulfur compounds are captured by limestone in the combustion process to eliminate downstream sulfur corrosion. The desulfurized flue
9	(H2S) and other sulfur compounds removed from gasoline and other fuel products to elemental sulfur. These	sulfur compounds are contaminants in the upstream processes and various products, and would be pollutants in discharged waste
10	schematic process flow diagrams included as Figures 1 and 2. In the sulfur plant section, H2S and other	sulfur compounds are converted to elemental sulfur which is condensed to liquid (it can subsequently be solidified into
11	atio Effect on Iron Sulfide (FeS) Scale Properties Challenged in Continuous Oil Flow ABSTRACTNaphthenic (NAP) acids and	sulfur compounds are important corrosive species contained in low quality crudes and can cause significant equipment damage when
12	cause of failures in the refining industry1.Whereas the corrosion mechanism seems straightforward ”metal reacting with	sulfur compounds at high temperature resulting in a wall thinning”, multiple parameters have to be taken into account
13	and adapt configuration changes of the system to avoid co-elution and for accurate measurement of individual	sulfur compounds at ultralow level in the matrix of butane, propane and LNG. This involves standardization, validation and
14	) that reacts with the steel surface. It is widely accepted that the corrosion from naphthenic acids and	sulfur compounds can be represented by the following reactions: 3, 4" "Guest Editorial: A Carbon Tax Would Be Good for
15	and heavier hydrocarbons. Also gases always include the water vapor and components such as nitrogen, hydrogen sulfide,	sulfur compounds, carbon dioxide and helium. The two-phase transport, as well as the risk of hydrate blockage
16	option is most often used when the recovery of natural-gas liquids is considered. Mercaptans and other	sulfur compounds concentrated in the liquid-hydrocarbon cuts are removed through a caustic-soda process or by molecular
17	in Europe, Russia and the Middle East, because of the appearance of more stringent specifications for total	sulfur compounds, especially mercaptans (RSH) and carbonyl sulfide (COS). It becomes challenging, nowadays, for oil and gas companies
18	have shown that the vast majority of these microbes require thiosulfate, elemental sulfur, (bi) sulfite, and other	sulfur compounds for energy production, and can therefore not be cultured using standard oilfield methods. This paper discusses
19	their corrosive effect. The FeS scale properties are influenced by different factors such as the types of	sulfur compounds in oil (sulfides, disulfides, mercaptans, thiophenes), NAP acid interactions, temperature, flow conditions - all factor

N	before sulfur compounds	after sulfur compounds
20	COS with propane. The use of methyl mercaptan as calibration standard simplifies the calibration process as all	sulfur compounds in our products have equimolar response in SCD. The innovation and advancement made in the instrument
21	, also in reservoir units from which no fluids are available. Based on available PVT data, the organo-	sulfur compounds in the condensate and the carbon isotope ratios of the adsorbed gas, we were able to
22	the sour gas accumulation. The isotopic signature of the gas, together with the composition of the organo-	sulfur compounds in the condensate, allow the reconstruction of fluid compositions, which are a critical input parameter for
23	s sector." "Identification of Compounds That Effectively Block Microbial H2S Production ABSTRACT Microbial reduction of	sulfur compounds is a concern in many industries due to the toxicity and corrosivity of the chief metabolic
24	be formed through natural chemical reactions, a varied population of microorganisms capable of metabolizing an array of	sulfur compounds is responsible for the biotic production of H2S. Current chemical treatment options for remediation of
25	the challenges frequently associated with their processing. Most opportunity crudes have increased acidity and reactive	sulfur compounds, making high temperature (~220–400°C) sulfidation-naphthenic acid (SNAP) corrosion a key concern for process and corros
26	der geologic conditions, with implications for immature petroleum decomposition and Type II-S kerogen maturation. Organ-	sulfur compounds may be more reactive than previously assumed, especially in presence of water. Even though the preliminary
27	components, revealed that paleo oil has less aromaticity than MPZ oil and lacks aromatic sulfur and di-	sulfur compounds, negligible amount of nitrogen compounds, and no resin type components. This study provides in depth information
28	of "green" is unclear for many people: does it mean decreasing emissions of polluting agents, such as	sulfur compounds, nitrogen oxides (NOx), fine particles, etc., all detrimental to human health? Or does it mean decreasing
29	the sensor response was evaluated. Sensor response was not affected below 1500 F. The effect of organo-	sulfur compounds on sensor response was also investigated." "Innovation and Technology Advancements in Measurement of Ultralow Sulfur in
30	energy demands with economic impact and benefits.1-7 The main constituents in the crude that cause corrosion are	sulfur compounds, organic and inorganic chlorides, salt water, organic and inorganic acids and nitrogen that forms ammonia and
31	the world.The natural gas fed to this plant is characterized by the presence of aromatic and	sulfur compounds (other than H2S), that can influence the absorption phenomenon, making the multiphysic approach adopted for
32	752°F). 2RCOOH + Feo → (RCOO) 2Fe + 2H• (1) Over the same temperature ranges, i.e. in similar locations, reactive	sulfur compounds oxidize iron metal to form insoluble iron sulfide scales. The sulfidation mechanism involves reactive sulfur (a
33	dioxide (CO2) removal. Sour-gas processing has recently seen the requirement of more-stringent specifications for total	sulfur compounds, particularly mercaptans and carbonyl sulfide. Producing sour-gas fields in an economic way became a challenge.
34	4, 20%CO2 and 12%H2S). Analytical work indicated that the nitrogen containing corrosion inhibitor (CI) polymerized with	sulfur compounds (polysulfides, elemental sulfur and/or H2S) in a type of a vulcanization process resulting in

N	before sulfur compounds	after sulfur compounds
35	Reduce the Number of Catalytic Units in Sulfur Recovery Units This document is an expanded abstract. Summary	Sulfur compounds present in crude oil and gas are absorbed primarily in the form of acid gas (H2
36	growing in the anoxic zone at the bottom of waste water treatment equipment reduce sulfate and other	sulfur compounds present in the waste water into H_2S. The gaseous H_2S rises and seeps into
37	nfluenced by a number of critical factors including concentration and molecular characteristics of naphthenic acids and	sulfur compounds, process temperature, oil fluid velocity and wall shear stress. This paper will comparatively and comprehensively revie
38	” crudes, which are usually lower quality, higher corrosivity crude oils with higher levels of naphthenic acids and	sulfur compounds. Processing of these high acid, high sulfur crudes has engendered significant corrosion concerns in hot oil
39	“alternate” crudes, which are usually low quality corrosive crude oils with high concentrations of naphthenic acids and	sulfur compounds.5 Processing of these highly acidic and sulfur-containing crudes at high temperatures in refineries has promoted
40	“alternate” crudes, which are usually low quality corrosive crude oils with high concentrations of naphthenic acids and	sulfur compounds. 8 Processing of these highly acidic and sulfur-containing crudes at high temperatures in refineries has promoted
41	are used in refineries and production gas plants to process the hydrogen sulfide (H_2S) and other	sulfur compounds removed from gasoline and other fuel products to elemental sulfur. These sulfur compounds are contaminants in
42	or associated gas reserves are currently identified as sour gases containing CO_2, H_2S and/or other	sulfur compounds, representing over 2600 trillion Cubic Feet (TCF). Dedicated treatments must be used to achieve the required specificat
43	KOH required to neutralize acid in one gram of oil). Crude oil contains a wide variety of	sulfur compounds, some reactive and some not - reactive sulfur compounds thermally decompose to form hydrogen sulfide (H_2S)
44	ive, acidophilic and chemolithotropic bacterium that utilizes oxidation of ferrous ions, hydrogen and reduced inorganic	sulfur compounds, such as H_2S, as sources of energy. Sulfur oxidation in A. ferroxidans is catalyzed by
45	GC with SCD has been identified as the best suitable one, for our products to determine individual	sulfur compounds such as hydrogen sulfide, carbonyl sulfide, methyl, ethyl, propyl, butyl mercaptans and total sulfur. Several trails
46	ossibly promote local modifications of physico-chemical conditions at the interface. Furthermore, SRB proliferate using	sulfur compounds such as sulfate, sulfite and sulfur as an electron acceptor that results in sulfide production. Sulfide
47	ompounds based on amine technology such as quaternary amines, amine ethoxylates, imidazolines and polyamides as well as	sulfur compounds such as thiourea. Phosphate esters and organic boron compounds may also be used, which are not
48	difficult to control. This experimental work intended to evaluate the properties of FeS scales formed from model	sulfur compounds (sulfides and mercaptans) in interaction with NAP acids using the “pretreatment - challenge” test protocol. According t
49	2S production and reservoir souring. These microbes are capable of reducing, not only sulfate, but most available	sulfur compounds that are present in the reservoir. A new class of compounds was recently identified and characterized

N	before sulfur compounds	after sulfur compounds
50	sulfidic corrosion (also known as sulfidation corrosion), is defined as the corrosion of metals/alloys by organic	sulfur compounds that are typically present in liquid hydrocarbons. Sulfidic corrosion is a well-known corrosion mechanism in
51	one five- or six-member rings. In the refinery, NAP corrosion is accompanied by corrosion from reactive	sulfur compounds (that may form H2S). High-temperature corrosion of steel is commonly represented by the following
52	burner and improved vacuum level by frequent maintenance of pumps improved the accuracy level of determination of	sulfur compounds. The products from plant were tested and monitored for these sulfur impurities daily and their level
53	of oil). Crude oil contains a wide variety of sulfur compounds, some reactive and some not - reactive	sulfur compounds thermally decompose to form hydrogen sulfide (H2S) that reacts with the steel surface. It is
54	5 wt% on average. High-temperature sulfidic corrosion involves two steps: 1) thermal cracking of carbon-sulfur bonds in	sulfur compounds to generate H2S; and 2) interaction of the H2S with iron in the steel to
55	to reservoir souring and highlight the need for additional field applications.INTRODUCTIONMicrobiological reduction of	sulfur compounds to hydrogen sulfide (H2S) within oil and gas production systems can have detrimental impacts on
56	pulations with a biocide or using calcium nitrate to selectively grow microorganisms that metabolize nitrate instead of	sulfur compounds. We have recently identified a number of novel compounds that have been proven successful in the
57	corrosivity. In this paper, the relative corrosivities of different types of sulfur species are explored. Four model	sulfur compounds were chosen based on relative thermal stability of carbon-sulfur bonds, which increased in the order
58	gas and condensate, which can be thermally extracted and analyzed. The extracted condensates are enriched in organo-	sulfur compounds, which can be used as proxies for the Thermochemical Sulfate Reduction (TSR) reaction and thus for
59	able to grow on the aerobic section of the equipment and oxidize the H2S into acidic	sulfur compounds which will quickly degrade concrete.5 SOB have also been implicated in the corrosion of metals. Beech

Remark: The file name in the collection with data on Figshare.com:OnePetro_ Sulfur compounds CONCAT title abstract 2015-2019-antconc_ results.tsv

28 results in 2010-2015 vs 59 results in 2015-2019. It is in coincidence with the results from Scopus and Dimensions.ai

The file name in the collection of data on Figshare.com (OnePetro): Scholarly Works over time data.csv

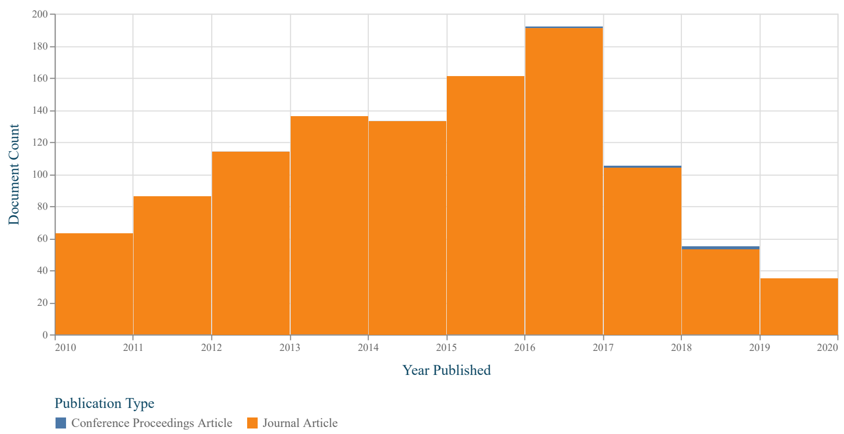


Figure 13. The number of publications by year. The average number of publications in 2015-2019 do not dramatically change comprised to 2010-2014, so the intermittent increase of usage of the term "sulfur compounds" after 2015 could not be explained by the increase of the number of publications

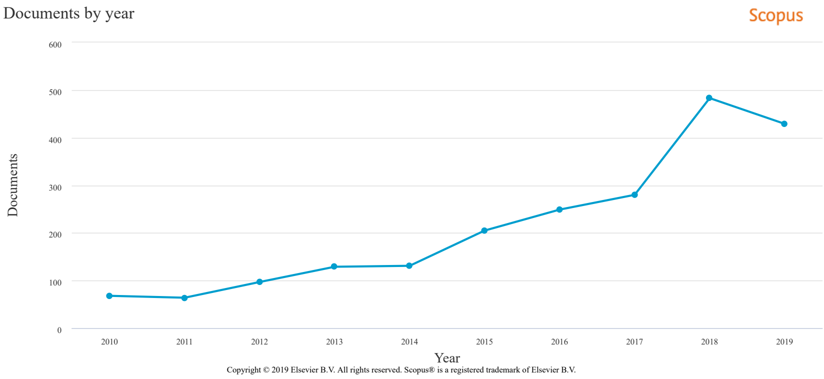


Figure 14. Increasing interest in the topic "Sulfur compounds AND petroleum" after 2015

Table 15. KW plus from WoS 165 results, comprise 2010-2014 vs 2015-2019

2010-2014 KWplus		2015-2019 KWplus	N
SULFATE-REDUCING BACTERIA	32	SULFATE-REDUCING BACTERIA	35
SEDIMENTS	10	REDUCTION	9
ORGANIC-MATTER	9	MARINE-SEDIMENTS	8
DIVERSITY	7	DIVERSITY	7
CARBON-STEEL	6	SULFATE-REDUCING BACTERIUM	6
HYDROGEN-SULFIDE	6	ANAEROBIC OXIDATION	5
MARINE-SEDIMENTS	6	BACTERIA	5
MICROBIAL COMMUNITIES	6	BIODEGRADATION	5
OXIDATION	5	GROWTH	5
REDUCTION	5	MODEL	5
SP-NOV	5	ORGANIC-MATTER	5
16S RIBOSOMAL-RNA	4	PRECIPITATION	5
BACTERIA	4	DEEP	4
EVOLUTION	4	HYDROGEN-SULFIDE	4
IRON	4	METHANE PRODUCTION	4
MICROBIAL MEDIATION	4	SEDIMENTS	4
PRECIPITATION	4	SP-NOV.	4
SULFATE-REDUCING BACTERIUM	4	WATER	4
ANAEROBIC METHANE OXIDATION	3	ARCHAEA	3
ARCHAEA	3	AROMATIC-HYDROCARBONS	3
BLACK-SEA	3	CARBON	3
CALCIUM-CARBONATE	3	CHEMISTRY	3
CARBON	3	CLAY	3
CHEMISTRY	3	COMMUNITY	3
DE-FUCA RIDGE	3	COMPACTED BENTONITE	3
DEEP	3	EVOLUTION	3
DEEP SUBSURFACE	3	EXTRACELLULAR POLYMERIC SUBSTANCES	3
DOLOMITE PRECIPITATION	3	GENOME SEQUENCE	3

2010-2014 KWplus		2015-2019 KWplus	N
ENVIRONMENT	3	GRANITIC GROUNDWATER	3
ESCHERICHIA-COLI	3	IRON	3

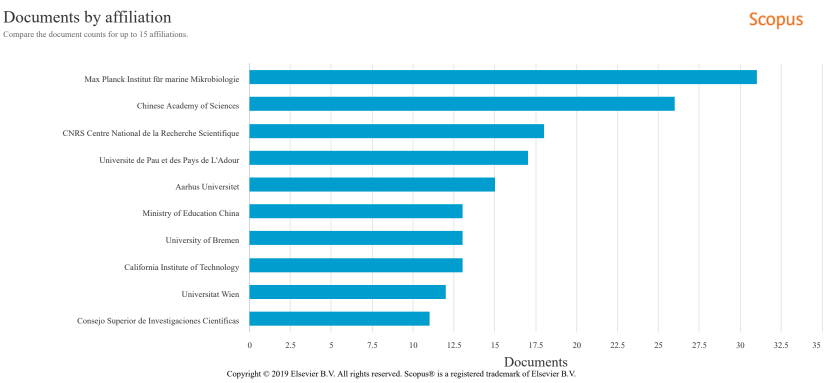
The file name in the collection of data on Figshare.com (WoS) [WoS-165-KWplus-2010-2014-vs-2015-2019-count.csv]

Addons

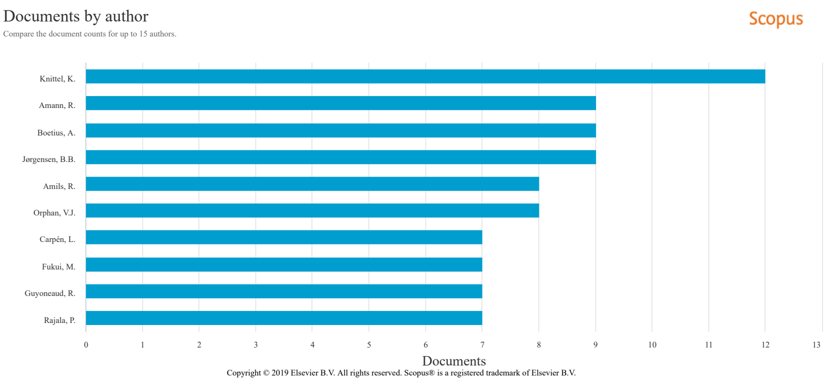
Addon 1: DATA from Scopus Analyze

Remark: you could download all files collection from Figshare.com as zip archive, browse them by names, or relatives links in .md or .html file

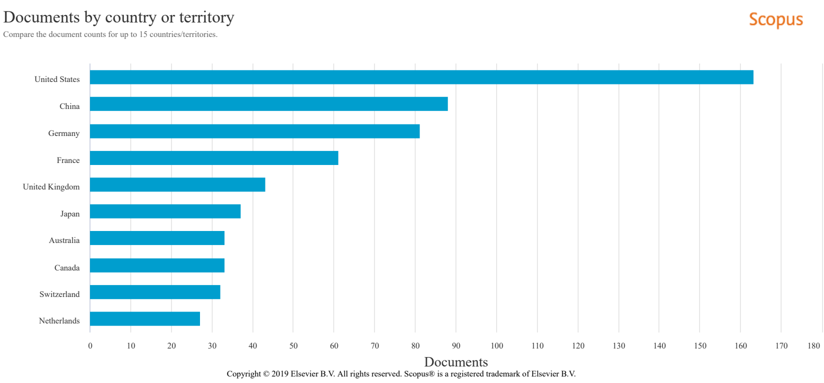
The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-Affiliation.csv]



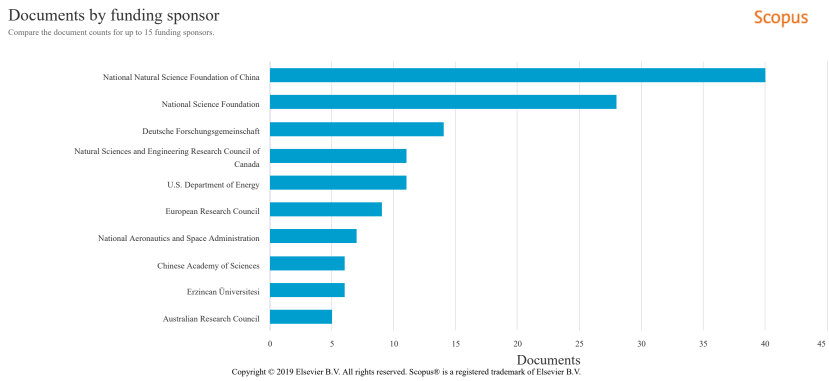
The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-Author.csv]



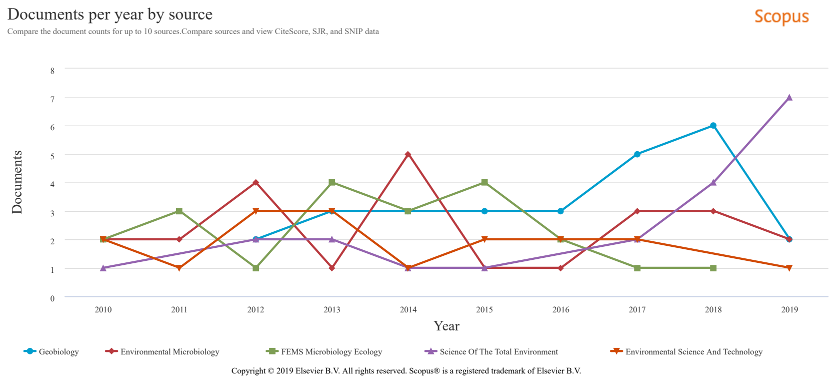
The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-Country.csv]



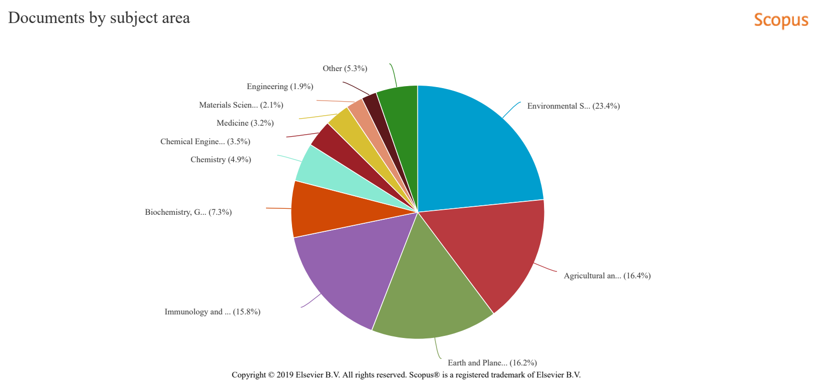
The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-FundingSponsor.csv]



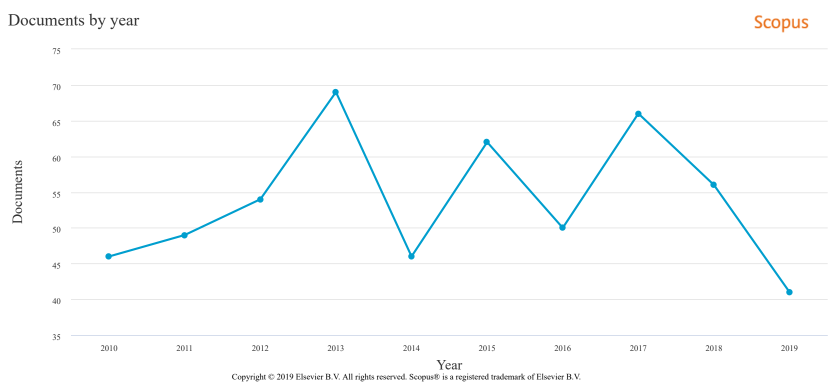
The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-Source.csv]



The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-Subject.csv]



The file name in the collection with data on Figshare.com: [Scopus-539-Analyze-Year.csv]



The file name in the collection of data on Figshare.com: [Scopus-539-Bibliographic_coupling-Organizations-2thr.txt]

The file name in the collection of data on Figshare.com: [Scopus-539-Co-occurrence Network Louvain bibliometrix.xlsx]

Scopus-539-KW-co-occurr-730kw-5thr.txt

Table 16. Main information about collection of 539 bibliometrics data from Scopus (by Bibliometrix R package)

Description	Results
Documents	538
Sources (Journals, Books, etc.)	182
Keywords Plus (ID)	5141
Author's Keywords (DE)	1177
Period	2010 - 2019
Average citations per documents	19.64
Authors	2325
Author Appearances	3066
Authors of single-authored documents	12
Authors of multi-authored documents	2313
Single-authored documents	13
Documents per Author	0.231
Authors per Document	4.32
Co-Authors per Documents	5.7
Collaboration Index	4.41
Document types	
ARTICLE	499
BOOK CHAPTER	9
CONFERENCE PAPER	18
CONFERENCE REVIEW	2
LETTER	3
REVIEW	7

The file name in the collection of data on Figshare.com: Scopus-539-Main Information about the collection bibliometrix.csv

The file name in the collection of data on Figshare.com: Scopus-539-source Source Impact bibliometrix.csv

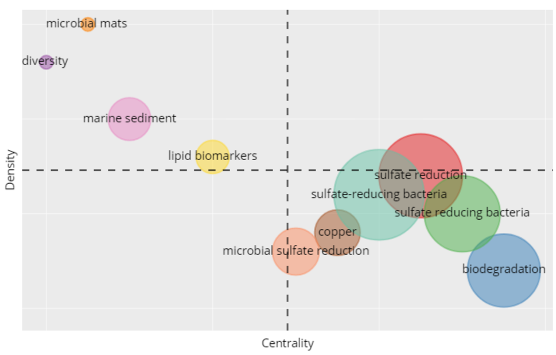


Figure 15. Thematic Map build by Bibliometrix R package for "Authors KeyWords" field from 539 Scopus data

> Co-word analysis draws clusters of keywords. They are considered as themes, whose density and centrality can be used in classifying themes and mapping in a two-dimensional diagram. http://bibliometrix.org/documents/bibliometrix_Report.html

> Definitions: In graph theory and network analysis, indicators of **centrality** identify the most important vertices within a graph. "**Network density**" describes the portion of the potential connections in a **network** that are actual connections.

The file name in the collection of data on Figshare.com: Scopus-539-Thematic Map Authors KeyWords bibliometrix.xlsx

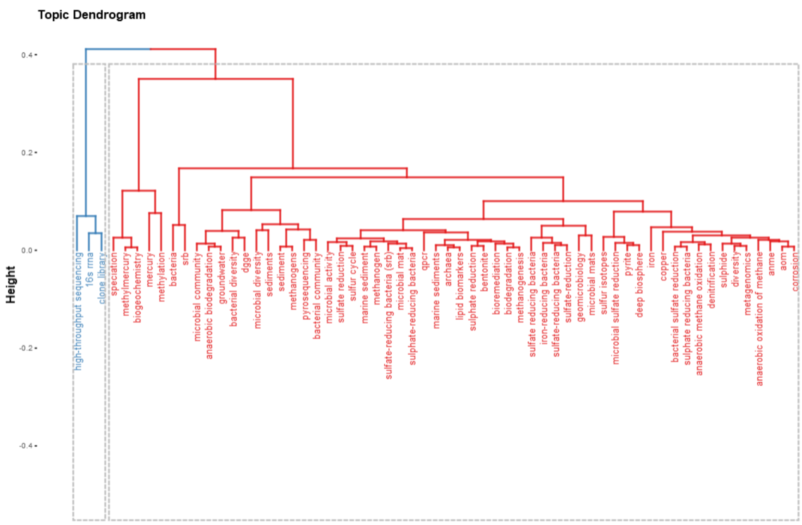


Figure 16. The Topic dendrogram build by Bibliometrix R package for "Authors KeyWords" field from 539 Scopus data

The file name in the collection of data on Figshare.com: sulfate_redusing_PMC_2019-09-30__KW.txt - KW from from Europe PubMed Central API by VOSviewer

Addon 2. Some information by Lens.org

Remark: you could download all files collection from Figshare.com as zip archive, browse them by names, or relatives links in .md or .html file

Table 17. Top 30 fields of study vs number of published documents

Field of Study	Document Count
Biology	497
Ecology	473
Geology	280
Chemistry	211
Sulfate	208
Environmental chemistry	168
Sediment	168
Sulfate-reducing bacteria	165
Geochemistry	134
Bacteria	131
Microbial population biology	127
Microbiology	118
Sulfur	113
Archaea	103
Anoxic waters	92

Field of Study	Document Count
Botany	89
Methane	86
Anaerobic oxidation of methane	85
Sulfide	85
Geomorphology	83
Biogeochemical cycle	81
Organic matter	80
Inorganic chemistry	75
Environmental engineering	68
Mineralogy	68
Biochemistry	66
Groundwater	64
Microorganism	64
Methanogenesis	63
Paleontology	62

Remark: The file name in the collection of data on Figshare.com: Top Fields of Study data.csv

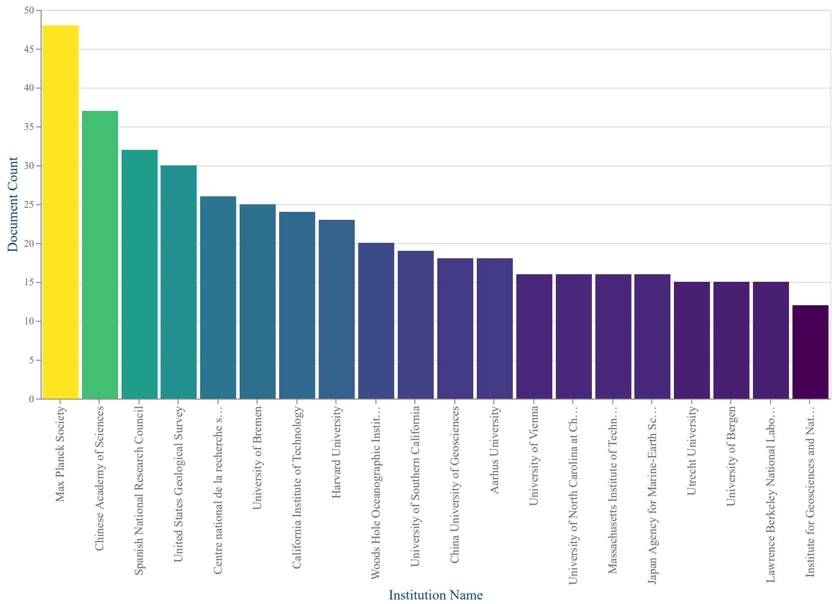


Figure 17. Top Institutions by number of Scholarly Works

Remark: The file name in the collection of data on Figshare.com: Top Institutions by number of Scholarly Works data.csv

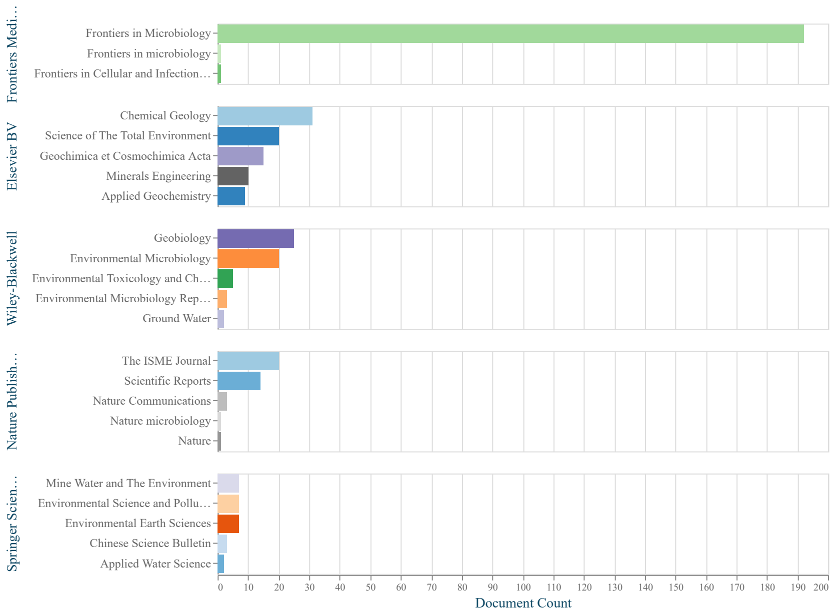


Figure 18. Top Journals by Publisher. The file name in the collection of data on Figshare.com: [Top Journals by Publisher data.csv]

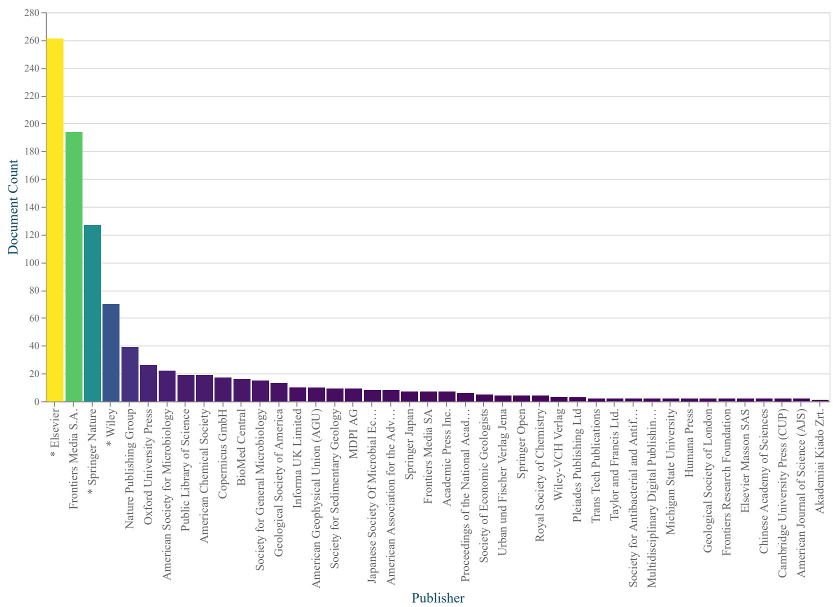


Figure 18. Top Publishers. The file name in the collection of data on Figshare.com: [Top Publishers data.csv]

Addon 3. Direct links to large figure files on figshare.com (file names are self explain)

- Lens_1080_LIKE geo Source Title - Field of Study KW VOSviewer RED cluster.png
- Lens_1080_top 19 Source Title - Field of Study KW VOSviewer.png
- Lens_1080_LIKE geo Source Title - Field of Study KW VOSviewer.png
- Scopus-539-KW-co-occurr-730kw-5thr.png
- Scopus-539-KW-co-occurr-730kw-5thr-Overlay.png
- Lens_1080_LIKE China Funding - Field of Study KW VOSviewer.png
- sulfate_redusing_PMC_2019-09-30 GML.gml
- sulfate_redusing_bacteria_PMC_2019-09-30.png
- sulfate_redusing_PMC_2019-09-30 170157.png
- Scopus-539-KW-co-occurr-730kw-5thr-(Sulfur_compounds-top-new-KW).png
- sulfate_redusing_Geological_sediments_PMC_2019-09-30 170157.png
- Scopus_539-CONCAT_title-abstrect-indexKW-2010-2014 TermExtract-Tree.svg
- Scopus_539-CONCAT_title-abstrect-indexKW-2015-2019 TermExtract-Tree.svg

Remark: LIKE geo Source Title stand for "Source Title" field contain the substring "geo"; Field of Study KW VOSviewer stand for the values of the field "Field of Study" in Lens data were used as KW in VOSviewer; CONCAT - fields title-abstrect-indexKW in Scopus data were concatenate, clean and then used as corpus for TermExtract of KH Coder 3; 5thr stand for threshold 5 in VOSviewer; PMC - data from Europe PubMed Central API by VOSviewer; LIKE China Funding - the field "Funding Details" of Lens contain the substring "China Funding"

Addon 4. The reasons for choosing main query

Sulfate-reducing
Scholarly Works (102,846) = Sulfate-reducing
Filters: Year published = (1950 - 2019) Publication Type = (Journal Article , Conference Proceedings Article)
Scholarly Works (52,754) = Sulfate-reducing
Filters: Year published = (2010 - 2019) Publication Type = (Journal Article , Conference Proceedings Article
Scholarly Works (5,059) = "Sulfate-reducing"
Filters: Year published = (2010 - 2019) Publication Type = (Journal Article , Conference Proceedings Article
Scholarly Works (5,059) = "Sulfate reducing"
Filters: Year published = (2010 - 2019) Publication Type = (Journal Article , Conference Proceedings Article
So, "Sulfate-reducing" or "Sulfate reducing" it does not matter
Works in Set - 5,059
Works Cited by Patents - 177
Citing Patents - 294
Patent Citations - 328
Works Cited by Scholarly - 4,131
Scholarly Citations - 88,147

Scholarly Works **(1,080) = "Sulfate reducing" AND geolog*** - the choice for this report
Filters: Year published = (2010 - 2019) Publication Type = (Journal Article , Conference Proceedings Article
Works in Set -1,080
Works Cited by Patents - 23
Citing Patents - 29
Patent Citations - 31
Works Cited by Scholarly - 995
Scholarly Citations - 23,648

SCOPUS
TITLE-ABS-KEY ((sulfate-reducing) AND geolog*) AND PUBYEAR > 2009; 539 document results

Funding:

The state contract **#AAAA-A19-119101690016-9** of the Ministry of Science and Higher Education of the Russian Federation

References:

- **KH Coder 3** (by HIGUCHI Koichi) is a free software for **quantitative content analysis** or **text mining**. It is also utilized for **computational linguistics**. https://khcoder.net/en/
- Van Eck, N.J., & Waltman, L. (2010). Software survey: **VOSviewer**, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523-538.
- Aria, M. & Cuccurullo, C. (2017) **bibliometrix:** An R-tool for comprehensive science mapping analysis, Journal of Informetrics, 11(4), pp 959-975, Elsevier.
- Anthony, L. (2019). **AntConc** (3.5.8) [Computer Software]. Tokyo, Japan: Waseda University. Available from https://www.laurenceanthony.net/software
- **SankeyMATIC** - a Sankey diagram builder. http://sankeymatic.com/

Boris Chigarev ORCID 0000-0001-9903-2800 https://figshare.com/authors/Boris_Chigarev/6474086