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

Coalbed Methane. 2015 - 2019 Bibliometric Analysis

Objectives: analysis of bibliometric data from recourses: SPE search, OnePetro, Dimensions, Lens and Scopus on topic "Coalbed methane". This research could be used as shot tutorial for bibliometric analysis of different publications DBs

Motivations:

Scientifically proven assessment of the coal-bearing formations' role as the major sources of methane accumulation in the Earth's crust opens up new wide horizons in building up the resources of hydrocarbon gases. Forecasted methane resources of the major coal basins in Russia are estimated to contain 83.7 trillion cubic meters making up approximately one-third of the country's forecasted natural gas resources. https://www.gazprom.com/about/production/extraction/metan/

Table 1. CBM Resources by Country.

Country	2010 Resources, Tcf
Russia	**2,824**
China	1,100
Alaska	1,037
U.S. (minus Alaska)	700
Australia	500
Canada	500
Indonesia	435
Poland	424

Table 2. Annual CBM Production by Country (2010 data).

Country	Production, Bcf
U.S. (minus Alaska)	1,886
Canada	320
Australia	190
China	50
Alaska	1
Russia	**0.5**
India	0.4
Kazakhstan	0.4

Cited by: EMD Coalbed Methane Committee Report. 2019 EMD Annual Leadership Meeting. San Antonio, Texas. May 18, 2019

SPE Search

Query: "Coalbed Methane" and filter: "Coal seam gas" gives **751 results**

Why extracting SPE categories/tags?

- to get the comprehensive description of the research landscape of the "Coalbed Methane" domain
- to have the possibility to build more complex queries for receiving relevance results

Why only "Coalbed Methane" and not ("Coalbed Methane" OR "Coal bed Methane" OR "coal seam gas")? Because operator "OR" doesn't work on this search engine. For example, "Coalbed Methane" gives 3,078 results, but "Coalbed Methane" OR "Coal bed Methane" gives 546 results.

Format: SPE category (number of publications mention this category)

- **SPE Disciplines (3066):** [Facilities Design, Construction and Operation (188); Health, Safety, Security, Environment and Social Responsibility (186); Management and Information (405); Production and Well Operations (284); **Reservoir Description and Dynamics (2664)**; Well

Completion (935); Well Drilling (272)]

Reservoir Description and Dynamics (2664): [Fluid Characterization (29); Formation Evaluation & Management (582); Improved and Enhanced Recovery (333); Non-Traditional Resources (3); Reserves Evaluation (90); Reservoir Characterization (574); Reservoir Fluid Dynamics (405); Reservoir Simulation (165); Storage Reservoir Engineering (53); **Unconventional and Complex Reservoirs (1716)**]

Unconventional and Complex Reservoirs (1716): [Carbonate reservoirs (6); **Coal seam gas (751);** Gas-condensate reservoirs (8); HP/HT reservoirs (3); Naturally-fractured reservoirs (75); Oil sand, oil shale, bitumen (36); Shale gas (578); Shale oil (55); Tight gas (57)]

- **Phanerozoic (48):** - Cenozoic (4): -- Neogene (1); -- Paleogene (1); - Mesozoic (11): -- Cretaceous (6); -- Triassic (1); - Paleozoic (18): -- Carboniferous (9); -- Permian (5)
- **Oilfield Places (616):** [Africa (9); Asia (180); Europe (117); North America (458); Oceania (139); South America (11)]

Asia (180): [Bangladesh (1); **China (111); India (32); Indonesia (32);** Japan (3); Malaysia (6); Middle East (17); Mongolia (1); Myanmar (2); *Russia (7);* Thailand (6); Vietnam (6)]

Europe (117): [Belgium (2); Czech Republic (11); Denmark (2); France (6); Germany (7); Netherlands (6); Norway (14); Poland (21); Romania (1); *Russia (15);* **United Kingdom (56)**]

Oceania (139): [**Australia (137);** Papua New Guinea (2); Timor-Leste (1)]

North America (458): [Canada (99); Mexico (3); Trinidad and Tobago (13); **United States (438)**]

China (111): [Anhui Province (3); Bohai Basin (1); Bohai Bay (2); East China Sea (1); Fujian (4); Gansu Province (1); Guizhou Province (2); Hebei Province (4); Heilongjiang Province (2); Henan Province (2); Inner Mongolia (2); Jilin Province (3); Liaoning Province (4); Northeast China (1); Northwest China (1); Qinghai Province (1); **Qinshui Basin (60); Shaanxi Province (32);** Shandong Province (3); Shanxi Province (4); Sichuan Province (11); **South China Sea (52);** Tianjin Province (1); Xinjiang **Uyghur Autonomous Region (11)**]

India (32): [Amalapuram Offshore (2); Andhra Pradesh Offshore (2); Arabian Sea (1); Cambay Basin (1); Chhattisgarh (1); Gujarat (3); Gujarat Offshore (1); **Jharkhand (8);** Karanpura Basin (1); Madhya Pradesh (1); Rajasthan (2); Rajmahal Basin (1); Raniganj Field (4); Rewan Formation (1); Satpura Basin (1); Tamil Nadhu Offshore (1); Tripura (2); West Bengal (5); West Bengal Basin (1)]

Indonesia (32): [East Kalimantan (10); East Kalimantan Offshore (10); Java (4); Kalimantan (3); Muara Enim Formation (3); Northeast Kalimantan (1); Pematang Field (1); South Sumatra (13); Sulawesi (1); Sumatra (9); West Java (3)]

United Kingdom (56): [England (1); **North Sea (49);** Northumberland Basin (1); Scotland (2); Tweed Basin (1)]

Russia (15): [**Northwestern Federal District (15);** Barents Sea (1); Ural Federal District (1)]

United States (438): [Alabama (2); Alaska (14); Arkansas (1); California (6); Colorado (283); Gulf of Mexico (38); Illinois (24); Indiana (24); Iowa (3); Kansas (10); **Kentucky (95);** Louisiana (9); Lousiana (1); **Maryland (65);** Michigan (9); Mississippi (16); Missouri (3); Montana (117); Nebraska (5); **New Mexico (305);** New York (5); North Carolina (1); North Dakota (11); **Ohio (66);** Oklahoma (35); Pennsylvania (66); South Dakota (2); Tennessee (1); **Texas (116); Utah (67);** Virginia (15); West **Virginia (90); Wyoming (134)**]

Australia (137): [**New South Wales (68);** Northern Territory (4); **Queensland (94);** South Australia (7); Timor Sea (1); Victoria (1); Western Australia (5)]

- **Country (598):** [Africa (1); Asia (117); Europe (18); North America (488); Oceania (44); South America (2)]

Asia (117): [Bangladesh (2); **China (46);** India (9); Indonesia (14); Japan (5); Malaysia (4); Middle East (3)]

Europe (18): [France (1); Germany (1); Poland (3); Russia (1); United Kingdom (2)]

North America (488): [Canada (29); **United States (412)**]

Oceania (44): [Australia (44)]

- **Concept Tag** (tag meets more than 100 times mark as bold)

adsorption (67); analysis (39); application (24); artificial intelligence (69); australia (25); basin (45); carbon dioxide (31); case (23); **cbm (116);** cbm reservoir (23); cbm well (35); change (39); china (37); cleat (102); co 2 (45); **coal (113); coal bed methane (750);** coal matrix (30); coal sample (30); coal seam gas (751); **coalbed methane (745);** coefficient (28); completion (33); complex reservoir (751); composition (24); concentration (42); desorption (79); development (44); diffusion (39); directional drilling (24); drilling (33); drilling operation (39); drillstem testing (59); drillstem/well testing (59); effect (31); engineering (32); enhanced recovery (86); equation (91); experiment (49); field (29); **flow in porous media (128); fluid dynamics (130);** formation (35); formation evaluation (88); **fracture (181);** gas production (51); horizontal (36); horizontal well (24); hydraulic fracture (29); **hydraulic fracturing (147);** increase (33); **injection (120);** isotherm (34); langmuir (39); management and information (26); matrix (71); method (23); model (78); modeling & simulation (30); natural gas (26); nitrogen (25); oil and gas (30); operation (44); operator (32); paper (60); **permeability (307);**

pore (33); porosity (66); **production (215);** production control (52); production monitoring (52); project (45); proppant (43); recovery (64); reservoir (45); **reservoir characterization (126); reservoir description and dynamics (412);** reservoir simulation (66); reservoir surveillance (52); resource (38); sample (65); san juan basin (31); saturation (31); sequestration (47); simulation (57); society of petroleum engineers (56); sorption (46); spe (49); stimulation (60); stress (50); study (26); system (55); technology (24); thickness (27); treatment (38); **upstream oil & gas (750);** water (93); well (138); well completion (83); wellbore (34)

Table 3. Extracting more details on fields areas. Example for United States. Additional filter for query: "formation"

State > Field OR Basin OR Formation	Number of Documents
California > Freeport Field	1
Colorado > Greater Green River Basin > Sand Wash Basin > Niobrara Formation	2
Colorado > Park Field	1
Colorado > Piceance Basin > Greater Grand Valley Field Complex Field > Williams Fork Formation	4
Colorado > Raton Basin	2
Colorado > San Juan Basin	12
Colorado > San Juan Basin > San Juan Basin Field > Fruitland Coal	2
Colorado > San Juan Basin > San Juan Basin Field > Pictured Cliffs Formation	1
Colorado > Uinta Basin	4
Colorado > Washakie Basin	1
Gulf of Mexico > Green Canyon > Block 110 > Rocky Field	1
Gulf of Mexico > Green Canyon > Block 563 > Warrior Field	1
Illinois > Illinois Basin	2
Indiana > Illinois Basin	2
Kentucky > Appalachian Basin	3
Kentucky > Cedar Hill Field	2
Kentucky > Illinois Basin	2
Kentucky > Pocahontas Basin	1
Maryland > Appalachian Basin	3
Mississippi > Black Creek Field	1
Mississippi > Raleigh Field	1
Montana > Powder River Basin	5
New Mexico > Farmington Field	1
New Mexico > Horseshoe Canyon Field	5
New Mexico > Huerfano Field	1
New Mexico > Mesaverde Group	2
New Mexico > Permian Basin	2
New Mexico > Raton Basin	2
New Mexico > Red Mountain Field	1
New Mexico > San Juan Basin	12
New Mexico > San Juan Basin > San Juan Basin Field > Fruitland Coal	2
New Mexico > San Juan Basin > San Juan Basin Field > Mancos Formation > Northeast Blanco Unit	1
New Mexico > San Juan Basin > San Juan Basin Field > Pictured Cliffs Formation	1
Ohio > Appalachian Basin	3
Ohio > Colfax Field	1
Oilfield Places > North America > Trinidad and Tobago > Trinidad Field	1
Oklahoma > Alabama Field	1
Oklahoma > Arkoma Basin > Cana Woodford Shale	2
Pennsylvania > Anthracite Basin	1
Pennsylvania > Appalachian Basin	3
South Dakota > Pierre Field	1
Texas > Canyon Formation	2
Texas > Fort Worth Basin > Pottsville Field	1
Texas > Gulf Coast Basin > Sun Field	1
Texas > Permian Basin	2
Texas > Permian Basin > Delaware Basin > Taurus Field	1

State > Field OR Basin OR Formation	Number of Documents
Texas > Permian Basin > Plains Field	1
Utah > Green River Basin	3
Utah > Mesaverde Formation	1
Utah > Uinta Basin	4
Virginia > Nora Field	1
Virginia > Pocahontas Basin	1
West Virginia > Appalachian Basin	3
West Virginia > Appalachian Basin > Mary Field > Marcellus Shale	2
West Virginia > Blue Creek Basin > Blue Creek Field	1
West Virginia > Pocahontas Basin	1
West Virginia > Rock Creek Field	3
Wyoming > Almond Formation	1
Wyoming > Greater Green River Basin > Sand Wash Basin > Niobrara Formation	2
Wyoming > Green River Basin	3
Wyoming > Powder River Basin	5
Wyoming > Uinta Basin	4
Wyoming > Washakie Basin	1
Wyoming > Wind River Basin	1

OnePetro

Using OnePetro ensure us to get results in petroleum domain of interest to SPE

Table 4. Search queries to OnePetro and returned results

Search for	Returned results
Coalbed Methane	2 734
"Coalbed Methane"	2 602
"Coal bed Methane" OR "Coalbed Methane"	3 351
"Coal bed Methane" OR "Coalbed Methane" OR "coal seam gas"	3 832
"Coal bed Methane" OR "Coalbed Methane" OR "coal seam gas", published between 2015 and 2019	866

Further we'll use 866 results to get bibliographic data in RIS format for text mining

KH Coder 3

Corpus was built from titles and abstracts of 866 RIS OnePetro files and consist of 866 paragraphs, 12601 sentences, 305151 (152939) tokens (in use)

Table 5. Top 200 results received by TermExtract of KH Coder 3. Score and term cluster as defined by TermExtract

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
gas production	91420,68429	relative permeability	6497,059246	formation water	3695,812247	production wells	2477,078434
natural gas	47427,1769	**shale oil**	6398,240369	fracture properties	3673,793699	total gas	2462,30044
hydraulic fracturing	46806,57448	experimental data	6371,243473	**shale matrix**	3628,695044	tight reservoirs	2431,785619
shale gas	44315,43898	gas permeability	6354,063143	reservoir simulation	3620,905256	work flow	2427,925053
gas reservoirs	23156,75981	oil recovery	6227,118559	gas reservoir	3597,637869	rock properties	2424,16946
unconventional reservoirs	22760,20593	co2 injection	6046,067991	reservoir conditions	3566,995891	gas storage	2407,833125
gas flow	20687,24205	**cbm reservoirs**	6043,508226	fracture system	3540,669501	co2 adsorption	2390,956048
gas industry	18488,95411	**coal seam gas**	6028,057072	**coal bed methane**	3540,253004	gas adsorption desorption	2333,997077
shale reservoirs	17909,23496	gas pressure	5999,541433	**coal surface**	3447,160226	injection pressure	2327,507127

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
shale gas reservoirs	16718,93972	reservoir model	5976,784753	new method	3424,646241	vertical wells	2309,360285
coal seam	16658,43814	**shale gas development**	5908,559214	**coalbed methane cbm**	3386,849455	experimental results	2302,970402
horizontal wells	16407,06574	**shale gas wells**	5876,004559	fractured reservoirs	3370,23081	gas field	2260,745108
tight gas	15988,8862	gas injection	5716,145042	fracture pressure	3359,939393	hydraulic fracturing operations	2259,130413
production data	15491,8284	**shale formations**	5617,104541	sweet gas	3322,995901	organic matter	2225,459831
coal permeability	14572,99892	numerical simulation	5523,947972	**tight oil reservoirs**	3267,896097	**gas shale**	2215,771949
coal seams	14118,90549	simulation results	5507,022676	formation damage	3239,943761	reservoir depletion	2162,24901
hydraulic fracture	13746,66574	**cbm wells**	5499,054132	simulation model	3193,628846	seismic data	2136,911637
shale gas production	13664,71179	two-phase flow	5480,023781	conventional oil	3185,053958	fracture model	2132,452469
natural fractures	12900,06186	gas water	5426,9733	fracture propagation	3127,219693	**methane production**	2131,873461
shale gas reservoir	11688,6377	production rate	5374,644424	conventional reservoirs	3118,380612	surat basin	2110,588469
fluid flow	11339,59355	capillary pressure	5266,029266	**shale permeability**	3071,360446	injection of co2	2102,980171
gas recovery	11163,11487	**coalbed methane**	5259,574014	**tight oil reservoir**	3046,226149	permeability change	2083,587929
oil production	10104,70549	unconventional oil	5245,167212	fracture initiation	3021,969838	oil wells	2064,981868
fracture network	9920,814527	fracture conductivity	5239,148032	cumulative gas production	2983,130155	complex fracture networks	2057,14291
water production	9570,002118	**gas desorption**	5107,829649	hydraulic fracturing process	2951,358674	cbm drilling	2052,966236
pore pressure	9397,450063	new model	4882,35752	**shale oil reservoirs**	2929,422133	production of water	2050,71474
unconventional gas	8815,133084	**tight oil**	4874,182934	**production of shale gas**	2928,152527	fluid viscosity	2041,887542
adsorbed gas	8782,108858	reservoir properties	4805,181557	water saturation	2915,533614	ultimate recovery	2041,316973
gas adsorption	8665,196021	cbm production	4709,051727	co2 sequestration	2902,796973	water production performance	2037,766941
field data	8411,127975	numerical model	4620,612851	reservoir parameters	2860,072316	effective permeability	2035,385705
low permeability	7978,139142	free gas	4606,326971	oil water	2849,249541	coal rock	2018,245856
gas wells	7866,35309	oil gas production	4566,505396	horizontal well	2831,781995	oil gas	2005,567833
fracture permeability	7828,662917	formation pressure	4539,706364	**cbm reservoir**	2816,761184	hydraulic fracturing treatment	2002,665186
hydraulic fractures	7687,212676	gas transport	4536,757143	reservoir characteristics	2790,942839	coal fines	2001,026897
produced water	7665,862218	gas rate	4518,008127	gas phase	2788,054396	gas drainage	1988,356446
shale reservoir	7651,549342	methane adsorption	4479,151354	gas fracturing	2735,540374	hydraulic fracture propagation	1976,173126
unconventional resources	7578,737447	fracture stimulation	4300,945713	natural fracture	2720,859364	**development of shale gas**	1969,519738
coal matrix	7568,106177	flow rate	4292,498922	fluid pressure	2716,68143	proposed model	1938,982676
reservoir pressure	7533,723662	case study	4254,363496	gas flow rate	2693,978636	marcellus shale	1929,913238
coal reservoir	7072,420314	mechanical properties	4202,046346	fracture networks	2692,795815	coalbed methane reservoir	1910,810901

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
natural gas production	6961,091846	field development	4188,867361	reservoir performance	2642,175513	fracturing pressure	1909,475605
production performance	6957,058499	**tight gas reservoir**	4095,638908	**coal bed methane reservoirs**	2623,630834	reservoir characterization	1908,459187
fluid properties	6931,046631	fracture geometry	4007,764794	co2 storage	2591,100111	original gas	1900,016711
effective stress	6838,746123	reservoir permeability	3989,451226	**methane gas**	2538,787603	oil reservoir	1888,818588
shale gas recovery	6788,317254	gas development	3981,365869	flow behavior	2533,809943	**coal seam gas wells**	1888,318234
unconventional gas reservoirs	6741,922146	hydrocarbon production	3963,089309	coal reservoirs	2529,041191	absolute permeability	1875,694171
shale formation	6706,481908	reservoir rock	3867,553559	coal seam gas reservoirs	2525,516118	matrix permeability	1867,713985
gas content	6604,427556	co2 fracturing	3774,03857	**coal bed methane cbm**	2514,381255	reservoir pore pressure	1846,447875
tight gas reservoirs	6566,368843	horizontal drilling	3745,065602	**shale samples**	2498,506719	high permeability	1834,495185
gas resources	6506,478086	water flow	3712,388069	**coal seam gas csg**	2479,929695	crude oil	1833,003586

Remark: coal bed methane, shale gas, tight gas, coal seam gas widely co-occurrence in the same corpus

Table 6. Filter: **fracture**. Top 80 results received by TermExtract of KH Coder 3

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
hydraulic fracture	13746.666	**natural fracture** permeability	1783.969	induced fracture network	761.093	fracture spacing	591.825
natural fractures	12900.062	fracture length	1671.800	hydraulic fracture stages	751.931	hydraulic fracture treatments	587.089
fracture network	9920.815	complex fracture network	1607.020	coal fracture permeability	746.153	fracture density	582.654
fracture permeability	7828.663	fracture distribution	1562.500	fracture porosity	744.036	fracture extension	574.362
hydraulic fractures	7687.213	fracture closure	1302.746	fracture flow	731.718	**natural fracture** properties	573.989
fracture conductivity	5239.148	fracture surface	1285.565	fractured shale gas reservoirs	717.643	fracture modeling	555.400
fracture stimulation	4300.946	fracture fluid	1162.465	fracture performance	707.025	fracture data	551.036
fracture geometry	4007.765	**natural fracture** system	1120.076	fracture height	705.277	hydraulic fracture modeling	543.674
fracture properties	3673.794	coal fracture networks	1096.127	reservoir fracture pressure	697.954	fracture characteristics	543.152
fracture system	3540.670	model fracture	1066.226	fracture treatment	690.919	fracture behavior	543.115
fractured reservoirs	3370.231	hydraulic fracture properties	982.779	discrete fracture model	683.436	hydraulic fracture spacing	535.963
fracture pressure	3359.939	fracture systems	952.522	main hydraulic fracture	679.698	fracture propagation model	534.292
fracture propagation	3127.220	fracture initiation pressure	946.348	fracture aperture	678.686	fracture morphology	528.700
fracture initiation	3021.970	induced fractures	944.315	fractured shale gas wells	670.723	fracture orientation	515.950
natural fracture	2720.859	induced fracture	938.960	hydraulic fracture stimulation	644.481	**natural fracture** distribution	515.301
fracture networks	2692.796	**natural fracture** network	930.582	main fracture	633.908	field fracture pressure	512.055
fracture model	2132.452	fractured gas reservoirs	886.422	hydraulic fracture treatment	628.859	fracture shales	506.322

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
complex fracture networks	2057.143	fractured reservoir	866.648	fractured shale reservoirs	616.521	multiple hydraulic fractures	505.059
hydraulic fracture propagation	1976.173	complex fracture geometry	852.345	fractured formations	601.424	initial fracture permeability	499.419
fracture complexity	1825.687	fractured wells	812.123	fracture fluid flow	594.093	**natural fracture** of coal	498.544

Remark: "natural fracture" is one of the core term in corpus

Table 7. Filter: **permeability**. Top 40 results received by TermExtract of KH Coder 3

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
coal permeability	14572.999	**matrix permeability**	1867.714	low permeability reservoirs	1295.756	**stress-dependent permeability**	806.861
low permeability	7978.139	high permeability	1834.495	permeability distribution	1289.113	dynamic permeability model	769.656
fracture permeability	7828.663	permeability data	1818.490	permeability of shale gas reservoirs	1257.182	permeability of coal seams	753.202
relative permeability	6497.059	**natural fracture permeability**	1783.969	permeability reduction	1227.947	**coal fracture permeability**	746.153
gas permeability	6354.063	effective water permeability	1767.242	formation permeability	1201.991	**permeability of shale rocks**	723.862
reservoir permeability	3989.451	permeability changes	1708.273	permeability models	1043.857	permeability of coal reservoir	713.081
shale permeability	3071.360	**rock permeability**	1707.695	**permeability of coal seam**	904.084	apparent permeability	693.858
permeability change	2083.588	porosity permeability	1534.635	**shale gas permeability**	896.572	dependent permeability	683.726
effective permeability	2035.386	permeability of coal	1387.905	relative permeability curves	840.834	low permeability coal	673.175
absolute permeability	1875.694	permeability model	1319.507	permeability evolution	820.029	permeability enhancement	669.704

Table 8. Filter: **adsorb***. Top 40 results received by TermExtract of KH Coder 3

Term cluster	Score	Term cluster	Score	Term cluster	Score	Term cluster	Score
adsorbed gas	8782.109	adsorbed water	134.881	adsorbed method	64.208	injected gas re-adsorbing	26.067
adsorbed phase	635.192	adsorbed methane	105.164	much adsorbed gas	63.675	adsorbed-phase density	18.461
adsorbed gas model	529.541	free adsorbed gas content	95.560	adsorbed ch4	61.919	adsorbed molecules	17.668
adsorbed gas content	475.061	adsorbed amount	87.805	adsorbed water film	60.421	adsorbed portion	15.596
adsorbed shale gas	330.814	mobile adsorbed phase	87.136	surface-adsorbed gas	51.973	adsorbed fluids of co2-c2h6 mixture	15.162
initial adsorbed gas	240.178	adsorbed-phase gas density	86.667	adsorbed fluids	43.334	volume of adsorbate	14.237
adsorbed fluid	214.955	adsorbed gas molecules	84.166	adsorbed gas doesn t	41.617	adsorbent volume shrinkage	13.893
adsorbed gas density	176.974	adsorbed state	77.210	adsorbed-gas phase porosity	31.553	adsorber bed	13.703
modeling adsorbed gas	171.412	adsorbed phase density	68.969	assumed adsorbed phase density	29.266	adsorbed-gas density	13.054
adsorbed gas reserves	154.068	adsorbed porosity	68.791	adsorbed amount of gases	28.750	assumed adsorbed-phase density	9.134

Figure 1. file on Figshare; 'Hierarchical Cluster Analysis of Words Corpus from OnePetro.svg' ; direct link: https://ndownloader.figshare.com/files/17003909

VOSViewer 1.6.11

Resource: eight RIS files from OnePetro, 866 records

Term clustering based on texts from titles and abstracts. Binary counting, the 29579 terms, 887 meet the threshold 8, 60% most relevant - 532

Figure 2. file: CoalBedMethane-866-RIS_OnePetro_Terms_co-occurrence.svg; direct link on figshare: https://ndownloader.figshare.com/files/17040197 Terms co-occurrence. Three clusters: adsorption - porosity - equation - pore_pressure - flued_flow - deformation - gas_reservoir - naturel_fracture - matrix; resource - operation - drilling - project - completion - industry - management; experiment - temperature - seam - damage - carbon_dioxide - emission - fracture_fluid

Table 9. Top 40 terms in each cluster, sorted by terms (Terms) occurrence (Occurr) . (Links - weight by VOSviewer)

Terms	Cluster	Links	Occurr	Terms	Cluster	Links	Occurr	Terms	Cluster	Links	Occurr
resource	1	464	139	porosity	2	447	117	experiment	3	433	114
operation	1	424	133	equation	2	390	109	seam	3	429	105
cost	1	411	116	matrix	2	403	79	temperature	3	395	95
year	1	455	116	hydraulic fracture	2	398	73	co2	3	376	88
project	1	383	101	natural fracture	2	379	72	sample	3	392	88
drilling	1	389	88	adsorption	2	341	64	concentration	3	354	66
industry	1	370	88	fracture network	2	354	63	storage	3	353	61
exploration	1	366	75	pore	2	327	59	fracturing fluid	3	296	51
risk	1	367	73	production data	2	341	57	damage	3	302	47
need	1	374	70	pore pressure	2	312	53	carbon dioxide	3	294	46
operator	1	347	68	shale reservoir	2	328	48	image	3	268	41
australia	1	323	64	coefficient	2	320	46	propagation	3	254	39
completion	1	334	62	desorption	2	287	45	emission	3	291	38
assessment	1	345	61	investigation	2	320	43	conductivity	3	260	37
location	1	309	58	numerical simulation	2	278	43	experimental study	3	267	37
management	1	291	55	shale formation	2	320	43	cleat	3	269	34
coal seam gas	1	321	54	depletion	2	282	41	proppant	3	217	34
workflow	1	297	53	production performance	2	284	41	stability	3	251	34
log	1	273	50	simulation result	2	314	41	particle	3	231	31
experience	1	294	49	theory	2	285	41	viscosity	3	224	31
requirement	1	310	49	shale gas reservoir	2	248	40	angle	3	238	28
success	1	315	49	decrease	2	281	39	coal sample	3	202	27
activity	1	299	48	diffusion	2	275	39	mechanical property	3	213	27
gas industry	1	290	48	boundary	2	253	36	ch4	3	225	26
aspect	1	315	46	experimental data	2	277	36	clay	3	234	26
framework	1	304	46	porous medium	2	273	36	diameter	3	226	26
company	1	255	45	core sample	2	270	35	experimental result	3	232	26
effort	1	326	45	deformation	2	279	35	formation damage	3	191	26
demand	1	300	44	fluid flow	2	275	35	fracture system	3	233	26
csg	1	265	43	site	2	261	35	mineral	3	201	26
focus	1	313	43	formulation	2	272	34	mining	3	209	26
practice	1	309	43	conventional reservoir	2	288	33	salinity	3	190	26
program	1	300	43	modulus	2	255	33	utilization	3	222	26
decade	1	318	42	effective stress	2	247	32	gase	3	236	25
world	1	339	42	fluid property	2	238	32	psi	3	203	25
growth	1	280	41	fracture geometry	2	229	32	coal matrix	3	231	24
facility	1	232	40	numerical model	2	272	32	eor	3	197	24
opportunity	1	281	39	reservoir model	2	245	32	brine	3	160	22

Terms	Cluster	Links	Occurr	Terms	Cluster	Links	Occurr	Terms	Cluster	Links	Occurr
review	1	242	39	reservoir simulator	2	250	30	high temperature	3	147	22
element	1	277	37	shale sample	2	208	30	coal permeability	3	176	21

Figure 3. file: 'Co-authorship based on RIS files form OnePetro.svg', direct link on figshare: https://ndownloader.figshare.com/files/17041364 Co-authorship based on RIS files form OnePetro. 2603 authors, 50 meet the threshold 5

Table 10. authors in each cluster, sorted by cluster (Cluster); occurrence (Occurr) ; (Links - weight by VOSviewer)

Author	Cluster	Links	Occurr	Author	Cluster	Links	Occurr
huang, zhongwei	1	7	10	mazumder, saikat	6	2	5
li, gensheng	1	9	14	zhang, ming	6	2	8
sheng, mao	1	7	5	ibrahim, ahmed farid	7	1	6
song, xianzhi	1	8	6	nasr-el-din, hisham a.	7	1	10
tian, shouceng	1	7	6	iglauer, stefan	8	1	5
wu, kan	1	4	5	lebedev, maxim	8	1	5
yang, ruiyue	1	7	10	li, yinghui	9	1	7
abdulraheem, abdulazeez	2	3	5	pu, hui	9	1	8
eliebid, mohammed	2	4	6	aguilera, roberto	10	0	6
elkatatny, salaheldin	2	4	7	akkutlu, i. yucel	11	0	6
mahmoud, mohamed	2	4	9	bedrikovetsky, p.	12	0	5
shawabkeh, reyad	2	3	5	bedrikovetsky, pavel	13	0	5
chen, zhiming	3	4	6	carpenter, chris	14	0	6
liao, xinwei	3	3	6	chen, shengnan	15	0	5
sepehrnoori, kamy	3	10	18	clarkson, c. r.	16	0	6
yu, wei	3	10	16	du, qizhen	17	0	8
bottomley, w.	4	1	5	elsworth, derek	18	0	6
firouzi, mahshid	4	1	5	ertekin, turgay	19	0	6
rudolph, victor	4	2	6	liang, feng	20	0	6
rufford, thomas e.	4	2	6	mostaghimi, peyman	21	0	7
li, jing	5	3	5	pan, zhejun	22	0	8
li, xiangfang	5	3	9	temizel, cenk	23	0	6
shi, juntai	5	3	7	wang, hanyi	24	0	5
wu, keliu	5	3	7	whitfield, stephen	25	0	6
lau, hon chung	6	2	9	zhang, dongxiao	26	0	5

Dimensions

While OnePetro and SPE search are affiliated with SPE, Dimensions.ai has close relations with **Springer - Nature - Wiley** publishers

Some query results: "Coal bed Methane" PUBLICATIONS -> 7,743; 2010 -> 313; 2018 -> 898 "Coalbed Methane" PUBLICATIONS -> 9,945 2010 -> 291 2018 -> 1296 "coal seam gas" PUBLICATIONS -> 122,282; 2010 -2018 (Chapter -> 92,315; Article -> 26,584; Monograph -> 2,363) Only Articles: "coal seam gas" AND Articles PUBLICATIONS -> 26,584; 2010 -> 663; 2018 -> 2636; 3.97 times growth in 8 years

Final query: "Coal bed Methane" OR "Coalbed Methane" OR "coal seam gas" AND "publication year 2015 - 2019" AND "publication type article" ; PUBLICATIONS -> 1672; 2015 -> 257; 2018 -> 425; 1.65 times growth in 4 years; more than mean common results

Table 11. Top 50 cited publications from 1672 bibliographic data. More data in file: 'Dimensions-Publication-2019-08-01_1672-docs-articles_list-coalbed methane 2015-2019.tsv'; direct link for full table: https://ndownloader.figshare.com/files/17060867

Title	Source title	PubYear	Authors	Times cited
Influence of sorption time in CO2-ECBM process in Indian coals using coupled numerical simulation	Fuel	2015	Vishal, V.; Singh, T.N.; Ranjith, P.G.	72
Porosity and permeability characterization of coal: a micro-computed tomography study	International Journal of Coal Geology	2016	Ramandi, Hamed Lamei; Mostaghimi, Peyman; Armstrong, Ryan T.; Saadatfar, Mohammad; Pinczewski, W. Val	67

Title	Source title	PubYear	Authors	Times cited
Novel integrated techniques of drilling–slotting–separation-sealing for enhanced coal bed methane recovery in underground coal mines	Journal of Natural Gas Science and Engineering	2015	Zou, Quanle; Lin, Baiquan; Zheng, Chunshan; Hao, Zhiyong; Zhai, Cheng; Liu, Ting; Liang, Jinyan; Yan, Fazhi; Yang, Wei; Zhu, Chuanjie	63
Methane production from coal by a single methanogen	Science	2016	Mayumi, Daisuke; Mochimaru, Hanako; Tamaki, Hideyuki; Yamamoto, Kyosuke; Yoshioka, Hideyoshi; Suzuki, Yuichiro; Kamagata, Yoichi; Sakata, Susumu	61
Formation, distribution, potential and prediction of global conventional and unconventional hydrocarbon resources	Petroleum Exploration and Development	2015	Caineng, ZOU; Guangming, ZHAI; ZHANG, Guangya; Hongjun, WANG; ZHANG, Guosheng; Jianzhong, LI; Zhaoming, WANG; Zhixin, WEN; Feng, MA; LIANG, Yingbo; Zhi, YANG; Xin, LI; LIANG, Kun	59
Characteristics of pore structure and fractal dimension of low-rank coal: A case study of Lower Jurassic Xishanyao coal in the southern Junggar Basin, NW China	Fuel	2017	Fu, Haijiao; Tang, Dazhen; Xu, Ting; Xu, Hao; Tao, Shu; Li, Song; Yin, ZhenYong; Chen, Baoli; Zhang, Cheng; Wang, Linlin	58
A novel ECBM extraction technology based on the integration of hydraulic slotting and hydraulic fracturing	Journal of Natural Gas Science and Engineering	2015	Yan, Fazhi; Lin, Baiquan; Zhu, Chuanjie; Shen, Chunming; Zou, Quanle; Guo, Chang; Liu, Ting	57
Fractal characterization of pore–fracture in low-rank coals using a low-field NMR relaxation method	Fuel	2016	Zhou, Sandong; Liu, Dameng; Cai, Yidong; Yao, Yanbin	52
Experimental study on removing water blocking effect (WBE) from two aspects of the pore negative pressure and surfactants	Journal of Natural Gas Science and Engineering	2016	Ni, Guanhua; Cheng, Weimin; Lin, Baiquan; Zhai, Cheng	48
An overview of the coal seam gas developments in Queensland	Journal of Natural Gas Science and Engineering	2016	Towler, Brian; Firouzi, Mahshid; Underschultz, James; Rifkin, Will; Garnett, Andrew; Schultz, Helen; Esterle, Joan; Tyson, Stephen; Witt, Katherine	47
Swelling-induced changes in coal microstructure due to supercritical CO2 injection	Geophysical Research Letters	2016	Zhang, Yihuai; Lebedev, Maxim; Sarmadivaleh, Mohammad; Barifcani, Ahmed; Iglauer, Stefan	46
A Mathematical Model of Coupled Gas Flow and Coal Deformation with Gas Diffusion and Klinkenberg Effects	Rock Mechanics and Rock Engineering	2015	Liu, Qingquan; Cheng, Yuanping; Zhou, Hongxing; Guo, Pinkun; An, Fenghua; Chen, Haidong	46
Coal cleat reconstruction using micro-computed tomography imaging	Fuel	2016	Jing, Yu; Armstrong, Ryan T.; Ramandi, Hamed Lamei; Mostaghimi, Peyman	42
FIB-SEM and X-ray CT characterization of interconnected pores in high-rank coal formed from regional metamorphism	Journal of Petroleum Science and Engineering	2017	Liu, Shiqi; Sang, Shuxun; Wang, Geoff; Ma, Jingsheng; Wang, Xin; Wang, Wenfeng; Du, Yi; Wang, Tian	40
A semi-analytical model for drainage and desorption area expansion during coal-bed methane production	Fuel	2017	Sun, Zheng; Li, Xiangfang; Shi, Juntai; Yu, Pengliang; Huang, Liang; Xia, Jun; Sun, Fengrui; Zhang, Tao; Feng, Dong	38
Swelling effect on coal micro structure and associated permeability reduction	Fuel	2016	Zhang, Yihuai; Lebedev, Maxim; Sarmadivaleh, Mohammad; Barifcani, Ahmed; Rahman, Taufiq; Iglauer, Stefan	38
Coal seam porosity and fracture heterogeneity of macrolithotypes in the Hancheng Block, eastern margin, Ordos Basin, China	International Journal of Coal Geology	2016	Zhao, Junlong; Xu, Hao; Tang, Dazhen; Mathews, Jonathan P.; Li, Song; Tao, Shu	38
Experimental study on porosity and permeability of anthracite coal under different stresses	Journal of Petroleum Science and Engineering	2015	Meng, Ya; Li, Zhiping; Lai, Fengpeng	37
Molecular simulation of CO2–CH4 competitive adsorption and induced coal swelling	Fuel	2015	Zhang, Junfang; Liu, Keyu; Clennell, M.B.; Dewhurst, D.N.; Pervukhina, M.	37

Title	Source title	PubYear	Authors	Times cited
High production indexes and the key factors in coalbed methane production: A case in the Hancheng block, southeastern Ordos Basin, China	Journal of Petroleum Science and Engineering	2015	Zhao, Junlong; Tang, Dazhen; Xu, Hao; Lv, Yumin; Tao, Shu	36
Fractal characterization and methane adsorption features of coal particles taken from shallow and deep coalmine layers	Fuel	2015	Sun, Wenjing; Feng, Yanyan; Jiang, Chengfa; Chu, Wei	35
Evaluation of coalbed methane potential of different reservoirs in western Guizhou and eastern Yunnan, China	Fuel	2015	Li, Song; Tang, Dazhen; Pan, Zhejun; Xu, Hao; Guo, Lele	35
Three-zone characterisation of coupled strata and gas behaviour in multi-seam mining	International Journal of Rock Mechanics and Mining Sciences	2015	Qu, Qingdong; Xu, Jialin; Wu, Renlun; Qin, Wei; Hu, Guozhong	33
Present-day stress orientation in the Clarence-Moreton Basin of New South Wales, Australia: a new high density dataset reveals local stress rotations	Basin Research	2017	Rajabi, Mojtaba; Tingay, Mark; King, Rosalind; Heidbach, Oliver	33
Permeability variation associated with fines production from anthracite coal during water injection	International Journal of Coal Geology	2015	Guo, Zhenghuai; Hussain, Furqan; Cinar, Yildiray	33
Geological and hydrological controls on water coproduced with coalbed methane in Liulin, eastern Ordos basin, ChinaGeology and Hydrogeology Associated with Coalbed Methane	AAPG Bulletin	2015	Li, Yong; Tang, Dazhen; Xu, Hao; Elsworth, Derek; Meng, Yanjun	32
An Analytical Model of Apparent Gas Permeability for Tight Porous Media	Transport in Porous Media	2016	Yuan, Yudong; Gholizadeh Doonechaly, Nima; Rahman, Sheik	32
Pore structure characterization of coal by NMR cryoporometry	Fuel	2017	Zhao, Yixin; Sun, Yingfeng; Liu, Shimin; Wang, Kai; Jiang, Yaodong	32
Continuous unconventional natural gas accumulations of Carboniferous-Permian coal-bearing strata in the Linxing area, northeastern Ordos basin, China	Journal of Natural Gas Science and Engineering	2016	Li, Yong; Tang, Dazhen; Wu, Peng; Niu, Xinlei; Wang, Kai; Qiao, Peng; Wang, Zhuangsen	31
Assessment of global unconventional oil and gas resources	Petroleum Exploration and Development	2016	Hongjun, WANG; Feng, MA; Xiaoguang, TONG; Zuodong, LIU; ZHANG, Xinshun; Zhenzhen, WU; Denghua, LI; Bo, WANG; Yinfu, XIE; Liuyan, YANG	31
Investigating the Effects of Seepage-Pores and Fractures on Coal Permeability by Fractal Analysis	Transport in Porous Media	2016	Cai, Yidong; Liu, Dameng; Pan, Zhejun; Che, Yao; Liu, Zhihua	31
A microfluidic framework for studying relative permeability in coal	International Journal of Coal Geology	2016	Gerami, Alireza; Mostaghimi, Peyman; Armstrong, Ryan T.; Zamani, Ali; Warkiani, Majid Ebrahimi	30
Rough-walled discrete fracture network modelling for coal characterisation	Fuel	2017	Jing, Yu; Armstrong, Ryan T.; Mostaghimi, Peyman	30
Experimental study on the petrophysical variation of different rank coals with microwave treatment	International Journal of Coal Geology	2016	Li, He; Lin, Baiquan; Yang, Wei; Zheng, Chunshan; Hong, Yidu; Gao, Yabin; Liu, Tong; Wu, Shiliang	30
Coal pore size distributions controlled by the coalification process: An experimental study of coals from the Junggar, Ordos and Qinshui basins in China	Fuel	2017	Li, Yong; Zhang, Cheng; Tang, Dazhen; Gan, Quan; Niu, Xinlei; Wang, Kai; Shen, Ruiyang	30
Production data analysis of coalbed methane wells to estimate the time required to reach to peak of gas production	International Journal of Coal Geology	2015	Salmachi, Alireza; Yarmohammadtooski, Zahra	29
Resources and geology of coalbed methane in China: a review	International Geology Review	2018	Qin, Yong; Moore, Tim A.; Shen, Jian; Yang, Zhaobiao; Shen, Yulin; Wang, Geoff	29
	Journal of			

Title	Source title	PubYear	Authors	Times cited
Predicting CO2 permeability of bituminous coal using statistical and adaptive neuro-fuzzy analysis	Natural Gas Science and Engineering	2017	Sharma, L.K.; Vishal, Vikram; Singh, T.N.	29
Evaluation of coal texture distributions in the southern Qinshui basin, North China: Investigation by a multiple geophysical logging method	International Journal of Coal Geology	2015	Teng, Juan; Yao, Yanbin; Liu, Dameng; Cai, Yidong	29
An experimental investigation of applicability of CO2 enhanced coal bed methane recovery to low rank coal	Fuel	2017	Ranathunga, A.S.; Perera, M.S.A.; Ranjith, P.G.; Wei, C.H.	28
A Laboratory Investigation of Permeability of Coal to Supercritical CO2	Geotechnical and Geological Engineering	2015	Vishal, V.; Singh, T. N.	28
Permeability evolution in sorbing media: analogies between organic-rich shale and coal	Geofluids	2016	Kumar, H.; Elsworth, D.; Mathews, J.P.; Marone, C.	28
Non-linear seepage characteristics and influential factors of water injection in gassy seams	Experimental Thermal and Fluid Science	2018	Cheng, Weimin; Liu, Zhen; Yang, He; Wang, Wenyu	27
Numerical simulation of hydraulic fracturing coalbed methane reservoir with independent fracture grid	Fuel	2015	Zhang, Jingchen; Bian, Xiaobing	26
Experimental study on the effect of moisture on low-rank coal adsorption characteristics	Journal of Natural Gas Science and Engineering	2015	Guo, Haijun; Cheng, Yuanping; Wang, Liang; Lu, Shouqing; Jin, Kan	26
Molecular simulation of CO2/CH4 self- and transport diffusion coefficients in coal	Fuel	2016	Zhao, Yongliang; Feng, Yanhui; Zhang, Xinxin	26
Experimental study of pulsating water pressure propagation in CBM reservoirs during pulse hydraulic fracturing	Journal of Natural Gas Science and Engineering	2015	Zhai, Cheng; Yu, Xu; Xiang, Xianwei; Li, Quangui; Wu, Shiliang; Xu, Jizhao	26
Methane and coal exploitation strategy of highly outburst-prone coal seam configurations	Journal of Natural Gas Science and Engineering	2015	Zhou, Hongxing; Zhang, Rong; Cheng, Yuanping; Dai, Hao; Ge, Chungui; Chen, Jiaxiang	26
A macro-scale experimental study of sub- and super-critical CO2 flow behaviour in Victorian brown coal	Fuel	2015	Ranathunga, A.S.; Perera, M.S.A.; Ranjith, P.G.; Ju, Y.; Vishal, V.; De Silva, P.N.K.	26
Evaluation of coal damage and cracking characteristics due to liquid nitrogen cooling on the basis of the energy evolution laws	Journal of Natural Gas Science and Engineering	2016	Cai, Chengzheng; Gao, Feng; Li, Gensheng; Huang, Zhongwei; Hou, Peng	26

Table 12. Clusters of authors from 1672 biblio data by VOSviewer 1.6.11; Cluster -> Clust; Links -> Lin; Documents -> Docs

Author	Clust	Lin	Docs	Author	Clust	Lin		Author	Clust	Lin		Author	Clust	Lin	Docs
guo, chen	1	3	6	chen, zhongwei	2	7	8	guo, chang	4	5	6	li, yong	7	8	12
jiang, bo	1	6	6	connell, luke d.	2	4	5	li, he	4	4	6	ren, ting	7	5	8
ju, wei	1	9	5	elsworth, derek	2	10	12	lin, baiquan	4	11	21	wang, gongda	7	3	5
li, lei	1	4	5	hu, guozhong	2	2	6	liu, ting	4	9	14	wang, kai	7	8	14
li, ming	1	6	5	liu, jishan	2	6	6	liu, tong	4	7	5	zhang, cun	7	2	5
liang, yunpei	1	3	7	pan, zhejun	2	20	25	yan, fazhi	4	10	10	zhang, lei	7	2	6
liu, shiqi	1	4	5	tang, zongqing	2	5	5	yang, wei	4	8	10	cai, yidong	8	8	21
qin, yong	1	17	29	xu, guang	2	5	5	zhu, chuanjie	4	8	9	gan, quan	8	8	6

Author	Clust	Lin	Docs	Author	Clust	Lin		Author	Clust	Lin		Author	Clust	Lin	Docs
sang, shuxun	1	4	10	yang, shengqiang	2	3	5	zou, quanle	4	13	15	liu, dameng	8	9	26
shen, jian	1	8	12	zhou, fubao	2	3	7	fu, xuehai	5	7	13	yao, yanbin	8	6	16
wang, gang	1	5	9	cheng, yuan-ping	3	3	5	li, xin	5	3	6	zhou, yingfang	8	5	6
wang, geoff	1	12	7	cheng, yuanping	3	12	23	peng, shoujian	5	6	7	ge, zhaolong	9	4	11
wei, chongtao	1	4	6	dong, jun	3	7	5	perera, m.s.a.	5	2	12	li, qian	9	7	5
wu, caifang	1	6	9	jiang, jingyu	3	6	7	ranathunga, a.s.	5	2	6	lu, yiyu	9	4	10
yang, yanhui	1	12	8	jin, kan	3	8	7	ranjith, p.g.	5	7	18	xia, binwei	9	4	5
yang, zhaobiao	1	6	7	li, wei	3	6	7	tang, xu	5	1	6	zhou, zhe	9	4	5
zou, mingjun	1	1	5	liu, shimin	3	17	23	wang, zhaofeng	5	2	8	qin, lei	10	6	10
				liu, zhengdong	3	6	5	xu, jiang	5	9	9	sun, yong	10	4	5
				wang, liang	3	10	14					xu, jizhao	10	4	12
				zhang, dongming	3	3	5					zhai, cheng	10	14	21
												gao, feng	11	3	12
												teng, teng	11	2	6
												xue, yi	11	2	8
												feng, ruimin	12	1	8
												harpalani, satya	12	2	8
												li, zhiping	13	4	7

Figure 4. Clusters of authors from 1672 biblio data by VOSviewer 1.6.11; See graph in file: 'Authors-co-occ-110-dimensions-1672-docs.png'; direct link: https://ndownloader.figshare.com/files/17061947

Figure 5. Bibliographic coupling - Organizations; 305 organizations, 85 meet the threshold 3; See graph in file: 'Bibliographic coupling-Organizations; 305 organizations 85 meet the threshold 3 dimensions 1672 docs.png'; direct link: https://ndownloader.figshare.com/files/17063474

Table 13. Clusters of Bibliographic coupling - Organizations; from 1672 biblio data by VOSviewer 1.6.11; Cluster -> Clust; Links -> Lin; Documents -> Docs

Organization	Clust	Lin	Docs	Organization	Clust	Lin	Docs	Organization	Clust	Lin	Docs
cardiff university	1	78	3	lawrence berkeley national laboratory	2	82	5	north china university of water conservancy and electric power	4	79	5
commonwealth scientific and industrial research organisation	1	83	9	liaoning technical university	2	83	11	northeast petroleum university	4	82	8
division of energy	1	82	6	pennsylvania state university	2	83	41	peking university	4	83	7
imperial college london	1	78	3	shandong university	2	81	5	state key laboratory of oil and gas reservoir geology and exploitation	4	83	19
indian institute of technology bombay	1	83	4	sichuan university	2	83	5	texas a&m university	4	77	4
indian institute of technology guwahati	1	81	3	southern illinois university system	2	83	8	the university of texas at austin	4	81	6
indian institute of technology roorkee	1	83	3	university of western australia	2	83	7	university of adelaide	4	83	19
jilin university	1	75	3	university of wollongong	2	83	10	wuhan university of technology	4	50	3

Organization	Clust	Lin	Docs	Organization	Clust	Lin	Docs	Organization	Clust	Lin	Docs
kunming university of science and technology	1	77	3	xi'an university of technology	2	72	3	agh university of science and technology	5	76	3
monash university	1	83	26	australian national university	3	80	3	central institute of mining and fuel research	5	83	7
northeastern university	1	82	7	china jiliang university	3	82	3	china geological survey	5	78	6
queensland university of technology	1	81	6	curtin university	3	83	14	indian institute of technology dhanbad	5	83	9
russian academy of sciences	1	65	4	edith cowan university	3	82	3	montana state university	5	78	4
sinopec (china)	1	83	18	heriot-watt university	3	81	3	taiyuan university of science and technology	5	78	3
taiyuan university of technology	1	83	12	northwest university	3	82	6	university of alberta	5	79	4
tiandi science & technology (china)	1	81	3	southwest jiaotong university	3	74	3	university of calgary	5	83	11
tsinghua university	1	80	3	university of aberdeen	3	83	13	university of chinese academy of sciences	5	82	8
university of melbourne	1	83	8	university of queensland	3	83	50	xinjiang university	5		
university of moratuwa	1	78	3	university of southern queensland	3	77	4	chengdu university of technology	6	77	7
university of science and technology beijing	1	81	4	university of wyoming	3	79	3	china university of geosciences	6	83	95
virginia tech	1	80	4	unsw sydney	3	83	22	guizhou university	6	82	4
china coal research institute (china)	2	83	7	xi'an jiaotong university	3	76	3	ministry of education of the people's republic of china	6	82	17
china university of mining and technology	2	83	282	xi'an university of science and technology	3	82	15	shandong university of science and technology	6	83	25
chongqing institute of geology and mineral resources	2	78	3	china national offshore oil corporation (china)	4	83	9	southwest petroleum university	6	82	8
chongqing university	2	83	51	china national petroleum corporation (china)	4	83	14	xi'an shiyou university	6	82	6
henan polytechnic university	2	83	50	china university of petroleum	4	83	18	anhui university of science and technology	7	82	11
hohai university	2	83	3	china university of petroleum, beijing	4	83	46	hunan university of science and technology	7	82	7
institute of rock and soil mechanics	2	83	10	hebei university of engineering	4	77	3				

Lens

Patents (912) = (Title: Coalbed Methane OR (Abstract: Coalbed Methane OR Claims: Coalbed Methane)) OR ((Title: Coal bed Methane OR (Abstract: Coal bed Methane OR Claims: Coal bed Methane)) OR (Title: coal seam gas OR (Abstract: coal seam gas OR Claims: coal seam gas))) ; Filters: Publication Date = (Jan 1, 2015 - Jan 1, 2019) Document Type = (Limited Patent , Granted Patent , Patent Application

Table 14. Patents by countries

Jurisdiction	Number of Patents	Jurisdiction	Number of Patents
CN	833	EA	4
US	50	JP	4

Jurisdiction	Number of Patents	Jurisdiction	Number of Patents
AU	34	RU	4
WO	33	BR	1
CA	14	HK	1
EP	14	IN	1
KR	6	ZA	1

Remark: China - 833 patents

Table 15. Top 36 IPCR Classifications

Code	N	Code	N
E21F7/00	31	E21F7/00;;E21B43/24;;E21B43/26	5
E21B43/00	22	G01N7/04	5
G01N15/08	14	C01F5/24;;C01B32/60;;C02F1/52;;C02F1/66	4
E21B43/26;;E21F7/00	12	C02F1/52;;C02F1/00;;C02F1/04;;C02F1/44	4
C10L3/10	11	C10G2/00;;B01D53/22;;C01B3/34;;C01B3/50;;C10K3/04	4
E21B43/26	10	E21B17/10	4
E21B49/00	10	E21B43/00;;E21B43/30	4
C25B1/00;;C01B7/03	9	E21B43/12	4
E21F7/00;;E21B43/00	9	E21B43/24;;E21F7/00	4
G01N33/22	9	E21B43/38	4
G01N33/24	9	E21B47/00	4
E21B43/22	8	E21F7/00;;E21C41/18;;E21C47/02	4
G01N7/14	8	F25J3/02	4
G01N1/08	6	G01N33/00	4
G06F17/50	6	G01N7/04;;G01N7/14	4
E21B43/16	5	G01N7/16	4
E21B47/06	5	G01V1/28	4
E21B47/06;;E21B33/13	5	G01V1/28;;G01V1/30	4

Remark: E21F 7/00 - Methods or devices for drawing-off gases with or without subsequent use of the gas for any purpose E21B 43/00 - Methods or apparatus for obtaining oil, gas, water, soluble or meltable materials or a slurry of minerals from wells (applicable only to water E03B; obtaining oil-bearing deposits or soluble or meltable materials by mining techniques E21C 41/00; pumps F04) https://www.wipo.int/classifications/ipc/ipcpub/?notion=scheme&version=20190101&symbol=none&menulang=en&lang=en&viewmode=f&fipcpc=no&showdeleted=yes&indexes=no&headings=yes¬es=yes&direction=o2n&initial=A&cwid=none&tree=no&searchmode=smart

Table 16. Top 30 patent titles Cited by Patent Count (N)

Patent Title	N
Device And Method For Evaluating Temporarily Freezing Plugging Properties Of Coalbed Methane In Process Of Fracturing	15
Method For Improving Coal Seam Gas Permeability Through High Energy Acoustoelectric Composite Technology	13
Logging Quantitative Evaluation Method Of Coal Bed Methane Reservoir Fracturing Capability	11
Coalbed Methane Horizontal Well Supercritical Co2 Jet Flow Cavity Construction And Multi-segment Synchronous Deflagration Fracturing Method	11
Metal Organic Framework Material Reinforcing Methane Adsorption Separation And Preparation And Application Thereof	11
Device And Method For Determination Of Coal Rock Isothermal Desorption Curve Under Saturated Water Condition	10
Method For Identification And Abundance Prediction Of Coalbed Methane Reservoirs	9
Method For Improving Coalbed Methane Collection Rate	9
Method For Determining Dynamic Reserve Volume Of Water Production Coal Seam Gas Well	9
Supercritical Co2 Injection And Coalbed Methane Enhanced Displacement Simulation Test Method	8
Drilling And Blanking Integrated And Heat Injection Coordinated Enhancing Method For Extracting Coal Seam Gas	8
Drilling, Punching And Cutting Coupled Pressure-relief Permeability-increase Method Of High-gas-outburst Coal Seam	8
Method For Relieving Water Blocking Damage Of Ground Coal-bed Methane Extracting And Drilling Coal Seam By Microwave Heating	7
Reinforced Anti-reflection Method For Promoting Gas Extraction	7
Method For Treating Low Air Permeability Coal Seam Gas Discharge	6

Patent Title	N
Horizontal Well Liquid Nitrogen Ice Crystal Temperature Plugging Staged Fracturing Method For Coalbed Methane	6
Coalbed Methane (cbm) Cluster Double Multi-branch Horizontal Well And Drilling Method Relative To Discharging And Mining Vertical Well System	6
Data-driven Analytics, Predictive Modeling & Opitmization Of Hydraulic Fracturing In Marcellus Shale	6
Coal And Gas Outburst Similarity Simulation Test Method Based On Geological Mechanical Model Test	6
Coalbed Methane Overall Volume Fracturing Optimization Design Method	5
Numerical Simulation Method Applied To Coalbed Methane Under Mining Conditions	5
Prediction Method For Coal And Gas Outburst Based On Seismic Information	5
Measurement Device For Adsorption And Desorption Of Multi-element Gas	5
Conversion Of Carbon Dioxide To Methanol Using Bi-reforming Of Methane Or Natural Gas	5
Drill Hole Drilling Method	5
Coal Sample Gas Negative Pressure Desorption Experimental System	5
System And Process For Coal Seam Permeability Improvement By Inducing Hole Drilling Extraction Later-period Gas Burning Explosion	5
Method For Preparation Of Coalbed Methane From Microorganisms	4
Microwave And Ultrasonic Synergistic Enhanced Coalbed Methane Recovery Method	4
Low-concentration Coalbed Methane Or Gas Electric Generating System	4

Table 17. Top 30 patent titles NPL (non-patent literature) Citation Count (N)

Patent Title	N
Enhanced Coal-bed Methane Production	34
System And Methods For Controlled Fracturing In Formations	11
Data-driven Analytics, Predictive Modeling & Opitmization Of Hydraulic Fracturing In Marcellus Shale	6
Casing Drilling Technique For Over-goaf	6
Adsorbent Having Utility For Co2 Capture From Gas Mixtures	6
Time Control Reservoir Parameter Modeling Method Used For Seismic Inversion	6
Method For Identification And Abundance Prediction Of Coalbed Methane Reservoirs	4
Method For Determining Dynamic Reserve Volume Of Water Production Coal Seam Gas Well	4
Drilling And Blanking Integrated And Heat Injection Coordinated Enhancing Method For Extracting Coal Seam Gas	4
Coal Seam Gas Based Residual Heat Resource Distributed Energy System	4
Supercritical Co2 Injection And Coalbed Methane Enhanced Displacement Simulation Test Device	4
Ceramsite Proppant For Well Producing Coalbed Methane From Coal Gangue And Preparation Method Thereof	4
Chemical Chain Combustion Method For Coalbed Methane, And Interconnected Fluidized Bed System	4
Mining Design Method For Near Total Rock Upper Protective Layer In Coal Seam Mining	4
System And Method For Producing Coal Bed Methane	4
Locating Pin Type Coal Seam Gas Content Measurement Sampling Device And Method	4
Three-dimensional Seismic Data Fixed Axial Section Dynamic Judgment Volume Rendering Method	4
Construction Method For Preventing And Treating Gas Outburst In Coal Roadway Heading Process	4
Device And Method For Simulating Influences Of Underground Water On Coalbed Methane	4
Method For Determining Drill Hole Effective Extracting Radius By Testing Coal Seam Gas Content And Gas Pressure Jointly	4
Methods Of Evaluating Undersaturated Coalbed Methane Reservoirs	4
Motor Drive System And Method	4
Adsorbent Having Utility For Co2 Capture From Gas Mixtures	4
Rapid Intelligent Determination Method Of Coal And Rock Mass Stress Characteristic Index	4
Supercritical Co2 Injection And Coalbed Methane Enhanced Displacement Simulation Test Method	3
Prediction Method For Coal And Gas Outburst Based On Seismic Information	3
Coal Seam Gas Fracturing And Mash Gas Driving Method	3
System And Methods For Controlled Fracturing In Formations	3
Protective Coal Seam Decompressing Ground And Underground Three-dimensional Coal And Coal Seam Gas Coordinated Development Method	3
Preparation Method And Application Of Deoxidization Ce-base Composite Oxide Catalyst For Coal-bed Methane	3

Lens Scholarly Analysis

Query: Scholarly Works (953) = Title: Coal bed Methane OR (Title: Coalbed Methane OR Title: coal seam gas) Filters: Year published = (2015 - 2019) External ID Type = (Microsoft Academic , Crossref , Core) Publication Type = (Journal Article , Conference Proceedings Article)

Table 18. the number of scholarly works over time for the most active institutions in this 953 set

Scholarly Institution	Year	N	Scholarly Institution	Year	N
China University of Mining and Technology	2018	38	China University of Geosciences	2019	7
China University of Mining and Technology	2019	32	Pennsylvania State University	2019	7
China University of Mining and Technology	2017	28	PetroChina	2015	6
China University of Mining and Technology	2016	20	Commonwealth Scientific and Industrial Research Organisation	2016	6
China University of Mining and Technology	2015	19	PetroChina	2016	6
China University of Petroleum	2015	18	China University of Geosciences	2017	6
China University of Petroleum	2019	15	University of Queensland	2019	5
China University of Geosciences	2015	13	Pennsylvania State University	2015	4
China University of Petroleum	2018	13	Queensland University of Technology	2016	4
University of Queensland	2016	12	Chongqing University	2017	4
University of Queensland	2015	11	Chinese Academy of Sciences	2018	4
China University of Geosciences	2016	11	Commonwealth Scientific and Industrial Research Organisation	2019	4
Commonwealth Scientific and Industrial Research Organisation	2018	11	Chinese Academy of Sciences	2015	3
PetroChina	2019	10	Chongqing University	2015	3
China University of Petroleum	2016	9	Chinese Academy of Sciences	2016	3
China University of Geosciences	2018	9	Pennsylvania State University	2017	3
University of Queensland	2018	9	PetroChina	2017	3
China University of Petroleum	2017	8	Chongqing University	2018	3
Pennsylvania State University	2018	8	Queensland University of Technology	2018	3
PetroChina	2018	8	Chongqing University	2019	3
Commonwealth Scientific and Industrial Research Organisation	2015	7	Chinese Academy of Sciences	2017	2
Queensland University of Technology	2015	7	Queensland University of Technology	2019	2
Commonwealth Scientific and Industrial Research Organisation	2017	7	Chongqing University	2016	1
Queensland University of Technology	2017	7	Pennsylvania State University	2016	1
University of Queensland	2017	7	Chinese Academy of Sciences	2019	1

Remark: See this data as chart on figshare, direct link to file 'Lens-953-Top Institution's Scholarly Works over time.svg' : https://ndownloader.figshare.com/files/17226899

Table 19. the top fields of study in the 953 set based on number of scholarly works

field of study	number of scholarly works	fields of study	number of scholarly works
Coalbed methane	525	Waste management	76
Petroleum engineering	425	Adsorption	71
Coal	412	Inorganic chemistry	66
Geology	328	Geomorphology	62
Coal mining	293	Environmental science	58
Methane	256	Permeability (electromagnetism)	58
Chemistry	248	Desorption	56
Geotechnical engineering	224	Chromatography	53
Structural basin	117	Porosity	47
Engineering	102	Drainage	44

Remark: See this data as chart on figshare, direct link to file 'Lens-953-Top Fields of Study.svg': https://ndownloader.figshare.com/files/17226890

Table 20. Top 40 results of Field of Study by Funding compared by Document Count

Field-Study	Funding by	Count	Field-Study	Funding by	Count
Coalbed methane	National Natural Science Foundation of China	102	Methane	Fundamental Research Funds for the Central Universities	16
Coal	National Natural Science Foundation of China	71	Coal	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	16
Chemistry	National Natural Science Foundation of China	61	Geology	Fundamental Research Funds for the Central Universities	15
Petroleum engineering	National Natural Science Foundation of China	55	Coal	China Postdoctoral Science Foundation	14
Methane	National Natural Science Foundation of China	48	Geology	National Science and Technology Major Project	13
Geology	National Natural Science Foundation of China	47	Coalbed methane	National Science and Technology Major Project of China	13
Geotechnical engineering	National Natural Science Foundation of China	45	Geotechnical engineering	National Science and Technology Major Project	12
Coalbed methane	Fundamental Research Funds for the Central Universities	37	Inorganic chemistry	Fundamental Research Funds for the Central Universities	11
Coal mining	National Natural Science Foundation of China	36	Chemistry	Ministry of Science and Technology of the People's Republic of China	11
Coal	Fundamental Research Funds for the Central Universities	33	Chemistry	China Postdoctoral Science Foundation	10
Petroleum engineering	Fundamental Research Funds for the Central Universities	25	Adsorption	Fundamental Research Funds for the Central Universities	10
Inorganic chemistry	National Natural Science Foundation of China	24	Coalbed methane	Ministry of Science and Technology of the People's Republic of China	10
Chemistry	Fundamental Research Funds for the Central Universities	23	Petroleum engineering	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	10
Adsorption	National Natural Science Foundation of China	20	Petroleum engineering	National Science and Technology Major Project	10
Coalbed methane	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	19	Petroleum engineering	National Science and Technology Major Project of China	10
Coalbed methane	National Science and Technology Major Project	19	Coal mining	China Postdoctoral Science Foundation	9
Geotechnical engineering	Fundamental Research Funds for the Central Universities	18	Geotechnical engineering	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	9
Chemistry	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	17	Coal	National Science and Technology Major Project	9
Coalbed methane	China Postdoctoral Science Foundation	16	Coal	National Science and Technology Major Project of China	9
Coal mining	Fundamental Research Funds for the Central Universities	16	Coal	Priority Academic Program Development of Jiangsu Higher Education Institutions	9

Remark: See this data as chart on figshare, direct link to file 'Lens-953-Top Field of Study by Funding compared by Document Count.svg' https://ndownloader.figshare.com/files/17226866 or as Sankey chart for 4 China Funding: https://ndownloader.figshare.com/files/17226863

Table 20. Top Field of Study by Institution compared by Document Count

Institution	Field of Study	Count	Institution	Field of Study	Count
China University of Geosciences	Coalbed methane	42	Commonwealth Scientific and Industrial Research Organisation	Coal mining	20

Institution	Field of Study	Count	Institution	Field of Study	Count
China University of Geosciences	Coal	27	Commonwealth Scientific and Industrial Research Organisation	Geology	18
China University of Geosciences	Petroleum engineering	26	Commonwealth Scientific and Industrial Research Organisation	Coalbed methane	15
China University of Geosciences	Geology	24	Commonwealth Scientific and Industrial Research Organisation	Petroleum engineering	14
China University of Geosciences	Geotechnical engineering	24	Commonwealth Scientific and Industrial Research Organisation	Coal	12
China University of Geosciences	Structural basin	20	Commonwealth Scientific and Industrial Research Organisation	Structural basin	10
China University of Geosciences	Chemistry	15	Commonwealth Scientific and Industrial Research Organisation	Geomorphology	9
China University of Geosciences	Coal mining	14	Commonwealth Scientific and Industrial Research Organisation	Geotechnical engineering	9
China University of Geosciences	Methane	9	Commonwealth Scientific and Industrial Research Organisation	Chemistry	8
China University of Geosciences	Desorption	7	Commonwealth Scientific and Industrial Research Organisation	Groundwater	7
China University of Mining and Technology	Coalbed methane	112	Pennsylvania State University	Coalbed methane	21
China University of Mining and Technology	Coal	97	Pennsylvania State University	Coal	13
China University of Mining and Technology	Geology	70	Pennsylvania State University	Chemistry	10
China University of Mining and Technology	Petroleum engineering	62	Pennsylvania State University	Petroleum engineering	10
China University of Mining and Technology	Geotechnical engineering	55	Pennsylvania State University	Geotechnical engineering	9
China University of Mining and Technology	Coal mining	52	Pennsylvania State University	Permeability (electromagnetism)	9
China University of Mining and Technology	Chemistry	50	Pennsylvania State University	Geology	8
China University of Mining and Technology	Methane	38	Pennsylvania State University	Coal mining	7
China University of Mining and Technology	Structural basin	24	Pennsylvania State University	Adsorption	6
China University of Mining and Technology	Borehole	22	Pennsylvania State University	Methane	6
China University of Petroleum	Coalbed methane	48	PetroChina	Coalbed methane	31
China University of Petroleum	Petroleum engineering	42	PetroChina	Petroleum engineering	20
China University of Petroleum	Chemistry	29	PetroChina	Geology	19
China University of Petroleum	Coal	22	PetroChina	Coal	16
China University of Petroleum	Geotechnical engineering	22	PetroChina	Structural basin	14
China University of Petroleum	Geology	18	PetroChina	Geotechnical engineering	10
China University of Petroleum	Methane	16	PetroChina	Coal mining	7
China University of Petroleum	Engineering	12	PetroChina	Chemistry	6
China University of Petroleum	Desorption	11	PetroChina	Geomorphology	6
China University of Petroleum	Inorganic chemistry	11	PetroChina	Permeability (electromagnetism)	5
Chinese Academy of Sciences	Coalbed methane	11	Queensland University of Technology	Coal mining	13
Chinese Academy of Sciences	Geology	10	Queensland University of Technology	Chemistry	9

Institution	Field of Study	Count	Institution	Field of Study	Count
Chinese Academy of Sciences	Petroleum engineering	8	Queensland University of Technology	Coal	7
Chinese Academy of Sciences	Coal	7	Queensland University of Technology	Geology	7
Chinese Academy of Sciences	Geotechnical engineering	5	Queensland University of Technology	Groundwater	7
Chinese Academy of Sciences	Geomorphology	4	Queensland University of Technology	Geomorphology	6
Chinese Academy of Sciences	Structural basin	4	Queensland University of Technology	Aquifer	5
Chinese Academy of Sciences	Coal mining	3	Queensland University of Technology	Petroleum engineering	5
Chinese Academy of Sciences	Chemistry	2	Queensland University of Technology	Bicarbonate	4
Chinese Academy of Sciences	Methane	2	Queensland University of Technology	Reverse osmosis	4
Chongqing University	Coalbed methane	11	University of Queensland	Coal mining	31
Chongqing University	Petroleum engineering	8	University of Queensland	Coal	26
Chongqing University	Coal	6	University of Queensland	Geology	20
Chongqing University	Coal mining	6	University of Queensland	Petroleum engineering	16
Chongqing University	Engineering	5	University of Queensland	Geotechnical engineering	15
Chongqing University	Geotechnical engineering	5	University of Queensland	Coalbed methane	12
Chongqing University	Methane	5	University of Queensland	Methane	10
Chongqing University	Borehole	4	University of Queensland	Chemistry	7
Chongqing University	Chemistry	4	University of Queensland	Geomorphology	7
Chongqing University	Geology	4	University of Queensland	Aquifer	5

Remark: See this data as chart on figshare, direct link to file 'Lens-953-Top Field of Study by Institution compared by Document Count.svg: https://ndownloader.figshare.com/files/17226881 or as Sankey chart, file 'Lens-953-Top Field of Study by Institution compared by Document Count-Sankey.svg', direct link: https://ndownloader.figshare.com/files/17226884

Table 21. Top Field of Study by Institution Country compared by Document Count

Country	Count	Field of Study	Country	Count	Field of Study
Australia	102	Coal mining	Indonesia	2	Coalbed methane
Australia	68	Coal	Indonesia	2	Hydraulic fracturing
Australia	63	Geology	Indonesia	2	Methane
Australia	49	Petroleum engineering	Indonesia	2	Microseism
Australia	43	Chemistry	Indonesia	1	Adaptive neuro fuzzy inference system
Australia	43	Coalbed methane	India	15	Coal
Australia	39	Geotechnical engineering	India	14	Methane
Australia	23	Methane	India	8	Coalbed methane
Australia	20	Geomorphology	India	7	Petroleum engineering
Australia	19	Aquifer	India	6	Chemistry
Canada	15	Coalbed methane	India	5	Geology
Canada	9	Chemistry	India	5	Waste management
Canada	8	Petroleum engineering	India	4	Coal mining
Canada	7	Coal	India	3	Environmental chemistry
Canada	5	Geology	India	3	Natural gas
Canada	4	Desorption	Netherlands	8	Petroleum engineering
Canada	4	Geotechnical engineering	Netherlands	6	Coal mining
Canada	3	Geomorphology	Netherlands	6	Coalbed methane
Canada	3	Inorganic chemistry	Netherlands	5	Geotechnical engineering
Canada	3	Permeability (electromagnetism)	Netherlands	4	Engineering
China	262	Coalbed methane	Netherlands	4	Geology
China	185	Coal	Netherlands	3	Mining engineering
China	160	Petroleum engineering	Netherlands	2	Chemistry

Country	Count	Field of Study	Country	Count	Field of Study
China	142	Geology	Netherlands	2	Structural basin
China	120	Geotechnical engineering	Netherlands	1	Artificial lift
China	119	Chemistry	Russia	6	Coalbed methane
China	91	Coal mining	Russia	6	Geology
China	88	Methane	Russia	5	Coal
China	48	Structural basin	Russia	5	Petroleum engineering
China	43	Adsorption	Russia	3	Coal mining
United Kingdom	7	Petroleum engineering	Russia	3	Geotechnical engineering
United Kingdom	6	Chemistry	Russia	3	Methane
United Kingdom	6	Coal	Russia	2	Arctic methane release
United Kingdom	6	Coal mining	Russia	2	Structural basin
United Kingdom	6	Coalbed methane	Russia	2	Waste management
United Kingdom	4	Geology	United States	68	Coalbed methane
United Kingdom	4	Methane	United States	48	Coal
United Kingdom	3	Inorganic chemistry	United States	39	Petroleum engineering
United Kingdom	3	Permeability (electromagnetism)	United States	35	Geology
United Kingdom	2	Geotechnical engineering	United States	33	Chemistry
Indonesia	4	Geology	United States	31	Geotechnical engineering
Indonesia	4	Petroleum engineering	United States	28	Methane
Indonesia	3	Coal	United States	20	Coal mining
Indonesia	2	Borehole	United States	19	Permeability (electromagnetism)
Indonesia	2	Coal mining	United States	11	Adsorption

Remark: See this data as chart on figshare, direct link to file 'Lens-953-Top Field of Study by Institution Country compared by Document Count.svg' : https://ndownloader.figshare.com/files/17227808 or as Sankey chart, file 'Lens-953-Top Field of Study by Institution Country compared by Document Count-Sankey.svg' https://ndownloader.figshare.com/files/17228033

Table 22. Top Institutions by Funding compared by Document Count

Funding	Count	Institution	Funding	Count	Institution
Australian Research Council	2	Southern Cross University	National Natural Science Foundation of China	45	China University of Mining and Technology
Australian Research Council	2	University of New South Wales	National Natural Science Foundation of China	18	China University of Geosciences
Australian Research Council	2	University of Queensland	National Natural Science Foundation of China	15	China University of Petroleum
Australian Research Council	1	Arrow Energy Pty Ltd, Brisbane, QLD 4000, Australia	National Natural Science Foundation of China	11	PetroChina
Australian Research Council	1	Australian National University	National Natural Science Foundation of China	8	Chongqing University
Australian Research Council	1	Department of Chemical Engineering, Curtin University, Perth, WA 6845, Australia	National Natural Science Foundation of China	7	Chinese Academy of Sciences
Australian Research Council	1	Institute of Molecular Science, Shanxi Key Laboratory of Materials for Energy Conversion and Storage, College of Chemistry & Chemical Engineering, Shanxi University, 92 Wucheng Road, Taiyuan 030006, China	National Natural Science Foundation of China	6	Commonwealth Scientific and Industrial Research Organisation
Australian Research Council	1	Jiangsu National Synergetic Innovation Center for Advanced Materials (SICAM), State Key Laboratory of Materials-Oriented Chemical Engineering, College of Energy, Nanjing Tech University, 5 Xin Mofan Road,	National Natural Science Foundation of China	6	University of Queensland

Funding	Count	Institution	Funding	Count	Institution
		Nanjing 210009, China			
Australian Research Council	1	Monash University	National Natural Science Foundation of China	4	China National Petroleum Corporation
Australian Research Council	1	Northeastern University	National Natural Science Foundation of China	4	Liaoning Technical University
China Postdoctoral Science Foundation	13	China University of Mining and Technology	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	9	China University of Mining and Technology
China Postdoctoral Science Foundation	3	Xi'an University of Science and Technology	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	4	China University of Geosciences
China Postdoctoral Science Foundation	2	Anhui University of Science and Technology	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	4	China University of Petroleum
China Postdoctoral Science Foundation	2	China University of Petroleum	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	3	Shandong University of Science and Technology
China Postdoctoral Science Foundation	2	Chinese Academy of Sciences	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	2	Anhui University of Science and Technology
China Postdoctoral Science Foundation	2	Ministry of Land and Resources of the People's Republic of China	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	2	Commonwealth Scientific and Industrial Research Organisation
China Postdoctoral Science Foundation	2	Pennsylvania State University	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	2	Lawrence Berkeley National Laboratory
China Postdoctoral Science Foundation	2	University of Queensland	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	2	Southwest Petroleum University
China Postdoctoral Science Foundation	1	China Geological Survey	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	1	Applied Science Private University
China Postdoctoral Science Foundation	1	China University of Geosciences	National Natural Science Foundation of ChinaNational Natural Science Foundation of China	1	China Coal Research Institute Xi'an Science and Industry Group, Xi'an, 710000, China

Funding	Count	Institution	Funding	Count	Institution
China Scholarship Council	2	China University of Mining and Technology	National Science and Technology Major Project	11	China University of Mining and Technology
China Scholarship Council	2	Southwest Petroleum University	National Science and Technology Major Project	5	China University of Petroleum
China Scholarship Council	1	China University of Geosciences	National Science and Technology Major Project	3	China University of Geosciences
China Scholarship Council	1	China University of Petroleum	National Science and Technology Major Project	3	PetroChina
China Scholarship Council	1	Chinese Academy of Sciences	National Science and Technology Major Project	3	Shandong University of Science and Technology
China Scholarship Council	1	Peking University	National Science and Technology Major Project	2	Chinese Academy of Sciences
China Scholarship Council	1	Pennsylvania State University	National Science and Technology Major Project	2	North China University of Water Conservancy and Electric Power
China Scholarship Council	1	University of Adelaide	National Science and Technology Major Project	1	Chinese Ministry of Education
China Scholarship Council	1	University of New South Wales	National Science and Technology Major Project	1	Chongqing University
China Scholarship Council	1	University of Tasmania	National Science and Technology Major Project	1	Dalian University of Technology
Fundamental Research Funds for the Central Universities	34	China University of Mining and Technology	National Science and Technology Major Project of China	4	China University of Mining and Technology
Fundamental Research Funds for the Central Universities	7	China University of Geosciences	National Science and Technology Major Project of China	3	Chongqing University
Fundamental Research Funds for the Central Universities	5	Pennsylvania State University	National Science and Technology Major Project of China	2	China University of Geosciences
Fundamental Research Funds for the Central Universities	4	Chongqing University	National Science and Technology Major Project of China	2	China University of Petroleum
Fundamental Research Funds for the Central Universities	3	Commonwealth Scientific and Industrial Research Organisation	National Science and Technology Major Project of China	2	Peking University

Funding	Count	Institution	Funding	Count	Institution
Fundamental Research Funds for the Central Universities	2	China University of Petroleum	National Science and Technology Major Project of China	2	Southwest Petroleum University
Fundamental Research Funds for the Central Universities	2	Chinese Academy of Sciences	National Science and Technology Major Project of China	1	Anhui University of Science and Technology
Fundamental Research Funds for the Central Universities	1	Anhui University of Science and Technology	National Science and Technology Major Project of China	1	China National Petroleum Corporation
Fundamental Research Funds for the Central Universities	1	Beijing Jiaotong University	National Science and Technology Major Project of China	1	China United Coalbed Methane Co. Ltd, Beijing, 100011, China
Fundamental Research Funds for the Central Universities	1	China Coal Technology and Engineering Group Chongqing Research Institute, Chongqing 400037, China	National Science and Technology Major Project of China	1	China United Coalbed Methane Co., Ltd., Beijing 100016, China
Ministry of Science and Technology of the People's Republic of China	3	China University of Petroleum	Priority Academic Program Development of Jiangsu Higher Education Institutions	9	China University of Mining and Technology
Ministry of Science and Technology of the People's Republic of China	2	Yangtze University	Priority Academic Program Development of Jiangsu Higher Education Institutions	4	Pennsylvania State University
Ministry of Science and Technology of the People's Republic of China	1	"Australian School of Petroleum, The University of Adelaide, Adelaide, South Australia 5005, Australia"	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	Chongqing University
Ministry of Science and Technology of the People's Republic of China	1	CNAF (Beijing) Airport Aviation Fuel Co., Ltd., Beijing, 102602, China	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	"Department of Energy and Mineral Engineering, G3 Center and Energy Institute, Pennsylvania State University, University Park, Pennsylvania 16802, United States"
Ministry of Science and Technology of the People's Republic of China	1	CNOOC Limited	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	"Department of Energy and Mineral Engineering, G3 Center and Energy Institute, Pennsylvania State University, University Park, Pennsylvania 16802, United States"

Funding	Count	Institution	Funding	Count	Institution
Ministry of Science and Technology of the People's Republic of China	1	China University of Mining and Technology	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	Guizhou Research Center of Shale Gas and Coalbed Methane Engineering Technology, Guiyang 550009, China
Ministry of Science and Technology of the People's Republic of China	1	Chinese Academy of Sciences	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	"Key Laboratory of Coal Methane and Fire Control, Ministry of Education, China University of Mining and Technology, Xuzhou, Jiangsu 221116, China"
Ministry of Science and Technology of the People's Republic of China	1	"Collegeof Earth Science, University of Chinese Academy of Sciences, Beijing 100049, China"	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	"Key Laboratory of Coal Methane and Fire Control, Ministry of Education, China University of Mining and Technology, Xuzhou, Jiangsu 221116, China"
Ministry of Science and Technology of the People's Republic of China	1	"College of Geosciences and Surveying Engineering, China University of Mining and Technology (Beijing), Beijing 100083, P. R. China"	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	Key Laboratory of Coal Methane and Fire Control, Ministry of Education, China University of Mining and Technology, Xuzhou, Jiangsu 221116, China
Ministry of Science and Technology of the People's Republic of China	1	"Department of Energy and Mineral Engineering, G3 Center and Energy Institute, Pennsylvania State University, University Park, Pennsylvania 16802, United States"	Priority Academic Program Development of Jiangsu Higher Education Institutions	1	Key Laboratory of Gas and Fire Control for Coal Mines (China University of Mining and Technology), Ministry of Education, Xuzhou 221116, China

Remark: See this data as chart on figshare, direct link to file 'Lens-953-Top Institutions by Funding compared by Document Count.svg': https://ndownloader.figshare.com/files/17228972 or as Sankey chart, file 'Lens-953-Top Institutions by Funding compared by Document Count-Sankey.svg' https://ndownloader.figshare.com/files/17229995

Scopus

Query : ((TITLE-ABS-KEY("Coal bed Methane" OR "Coalbed Methane" OR "coal seam gas") AND LANGUAGE(English)) AND DOCTYPE(ar OR re) AND PUBYEAR > 2014)

Table 23. Top 30 cited articles for a set of 1699 documents

Year	Title	Authors	Source	Cited
2015	Environmental health impacts of unconventional natural gas development: A review of the current strength of evidence	Werner A.K., Vink S., Watt K., Jagals P.	Science of the Total Environment	98
2015	Treatment of RO brine from CSG produced water by spiral-wound air gap membrane distillation - A pilot study	Duong H.C., Chivas A.R., Nelemans B., Duke M., Gray S., Cath T.Y., Nghiem L.D.	Desalination	96
2015	Enhanced microbial coalbed methane generation: A review of research, commercial activity, and remaining challenges	Ritter D., Vinson D., Barnhart E., Akob D.M., Fields M.W., Cunningham A.B., Orem W., McIntosh J.C.	International Journal of Coal Geology	87
2015	Fractal characteristics of pores in non-marine shales from the Huainan coalfield, eastern China	Bu H., Ju Y., Tan J., Wang G., Li X.	Journal of Natural Gas Science and Engineering	81
2015	Hydraulic fracturing water use variability in the United States and potential environmental implications	Gallegos T.J., Varela B.A., Haines S.S., Engle M.A.	Water Resources Research	79

Year	Title	Authors	Source	Cited
2016	Porosity and permeability characterization of coal: A micro-computed tomography study	Ramandi H.L., Mostaghimi P., Armstrong R.T., Saadatfar M., Pinczewski W.V.	International Journal of Coal Geology	75
2015	Influence of sorption time in CO2-ECBM process in Indian coals using coupled numerical simulation	Vishal V., Singh T.N., Ranjith P.G.	Fuel	74
2019	3-D AVO analysis and modeling applied to fracture detection in coalbed methane reservoirs	Ramos A.C.B., Davis T.L.	GEOPHYSICS	68
2015	Novel integrated techniques of drilling-slotting-separation-sealing for enhanced coal bed methane recovery in underground coal mines	Zou Q., Lin B., Zheng C., Hao Z., Zhai C., Liu T., Liang J., Yan F., Yang W., Zhu C.	Journal of Natural Gas Science and Engineering	67
2015	A novel ECBM extraction technology based on the integration of hydraulic slotting and hydraulic fracturing	Yan F., Lin B., Zhu C., Shen C., Zou Q., Guo C., Liu T.	Journal of Natural Gas Science and Engineering	67
2016	Recent developments in coal mine methane extraction and utilization in China: A review	Zhou F., Xia T., Wang X., Zhang Y., Sun Y., Liu J.	Journal of Natural Gas Science and Engineering	63
2016	Biogenic methane production from coal: A review on recent research and development on microbially enhanced coalbed methane (MECBM)	Park S.Y., Liang Y.	Fuel	63
2017	Characteristics of pore structure and fractal dimension of low-rank coal: A case study of Lower Jurassic Xishanyao coal in the southern Junggar Basin, NW China	Fu H., Tang D., Xu T., Xu H., Tao S., Li S., Yin Z., Chen B., Zhang C., Fu H., Tang D., Xu H., Tao S., Li S., Yin Z., Chen B., Zhang C., Wang L.	Fuel	59
2016	Multi-scale x-ray computed tomography analysis of coal microstructure and permeability changes as a function of effective stress	Zhang Y., Xu X., Lebedev M., Sarmadivaleh M., Barifcani A., Iglauer S.	International Journal of Coal Geology	58
2016	Fractal characterization of pore–fracture in low-rank coals using a low-field NMR relaxation method	Zhou S., Liu D., Cai Y., Yao Y.	Fuel	57
2016	Experimental study on removing water blocking effect (WBE) from two aspects of the pore negative pressure and surfactants	Ni G., Cheng W., Lin B., Zhai C.	Journal of Natural Gas Science and Engineering	54
2016	Methane production from coal by a single methanogen	Mayumi D., Mochimaru H., Tamaki H., Yamamoto K., Yoshioka H., Suzuki Y., Kamagata Y., Sakata S.	Science	50
2015	Molecular simulation of CO<inf>2</inf>-CH<inf>4</inf> competitive adsorption and induced coal swelling	Zhang J., Liu K., Clennell M.B., Dewhurst D.N., Pervukhina M.	Fuel	50
2016	Swelling-induced changes in coal microstructure due to supercritical CO2 injection	Zhang Y., Lebedev M., Sarmadivaleh M., Barifcani A., Iglauer S.	Geophysical Research Letters	49
2015	Fractal characterization and methane adsorption features of coal particles taken from shallow and deep coalmine layers	Sun W., Feng Y., Jiang C., Chu W.	Fuel	49
2015	Review of unconventional hydrocarbon resources in major energy consuming countries and efforts in realizing natural gas hydrates as afuture source of energy	Vedachalam N., Srinivasalu S., Rajendran G., Ramadass G.A., Atmanand M.A.	Journal of Natural Gas Science and Engineering	49
2017	Laboratory measurement of low permeability unconventional gas reservoir rocks: A review of experimental methods	Sander R., Pan Z., Connell L.D.	Journal of Natural Gas Science and Engineering	48
2016	An overview of the coal seam gas developments in Queensland	Towler B., Firouzi M., Underschultz J., Rifkin W., Garnett A., Schultz H., Esterle J., Tyson S., Witt K.	Journal of Natural Gas Science and Engineering	48

Year	Title	Authors	Source	Cited
2015	A Mathematical Model of Coupled Gas Flow and Coal Deformation with Gas Diffusion and Klinkenberg Effects	Liu Q., Cheng Y., Zhou H., Guo P., An F., Chen H.	Rock Mechanics and Rock Engineering	48
2015	Scaling control during membrane distillation of coal seam gas reverse osmosis brine	Duong H.C., Gray S., Duke M., Cath T.Y., Nghiem L.D.	Journal of Membrane Science	48
2016	Coal cleat reconstruction using micro-computed tomography imaging	Jing Y., Armstrong R.T., Ramandi H.L., Mostaghimi P.	Fuel	45
2015	Experiment of coal damage due to super-cooling with liquid nitrogen	Cai C., Li G., Huang Z., Tian S., Shen Z., Fu X.	Journal of Natural Gas Science and Engineering	43
2017	Pore structure characterization of coal by NMR cryoporometry	Zhao Y., Sun Y., Liu S., Wang K., Jiang Y.	Fuel	42
2017	Cleat-scale characterisation of coal: An overview	Mostaghimi P., Armstrong R.T., Gerami A., Hu Y., Jing Y., Kamali F., Liu M., Liu Z., Lu X., Ramandi H.L., Zamani A., Zhang Y.	Journal of Natural Gas Science and Engineering	42
2016	Graphene/PVDF flat-sheet membrane for the treatment of RO brine from coal seam gas produced water by air gap membrane distillation	Woo Y.C., Kim Y., Shim W.-G., Tijing L.D., Yao M., Nghiem L.D., Choi J.-S., Kim S.-H., Shon H.K.	Journal of Membrane Science	42

Remark: The full citation list are in file: Scopus-1699-citation overview.csv on figshare, direct link to download: https://ndownloader.figshare.com/files/17299139

Table 24. Top 30 affiliations

AFFILIATION	N
China University of Mining Technology	343
Ministry of Education China	243
China University of Geosciences, Beijing	137
University of Queensland	107
China University of Mining & Technology, Beijing	106
Henan Polytechnic University	101
China University of Petroleum - Beijing	91
Chongqing University	85
Pennsylvania State University	65
Commonwealth Scientific and Industrial Research Organization	64
Chinese Academy of Sciences	57
Southwest Petroleum University China	48
University of New South Wales UNSW Australia	42
Queensland University of Technology QUT	37
China University of Petroleum East China	34
China University of Geosciences, Wuhan	33
Monash University	33
Shandong University of Science and Technology	30
Taiyuan University of Technology	30
Research Institute of Petroleum Exploration and Development	30
University of Wollongong	28
The University of Adelaide	27

Remark: Full list in file: Scopus-1699-Analyze-Affiliation.csv on figshare

Table 25. Main Funding/Sponsors

Funding	N

Funding	N
National Natural Science Foundation of China	589
Fundamental Research Funds for the Central Universities	202
National Major Science and Technology Projects of China	106
China Postdoctoral Science Foundation	76
Priority Academic Program Development of Jiangsu Higher Education Institutions	69
China University of Mining and Technology	59
China Scholarship Council	51
National Basic Research Program of China (973 Program)	46
Australian Research Council	41
Natural Science Foundation of Jiangsu Province	34
State Key Laboratory of Coal Resources and Safe Mining	34
Natural Science Foundation of Shanxi Province	32
Major State Basic Research Development Program of China	28
Ministry of Education	24
China National Critical Project for Science and Technology on Water Pollution Prevention and Control	22
Henan Polytechnic University	21
National Natural Science Foundation of China-Yunnan Joint Fund	20
U.S. Department of Energy	20
Science Foundation of China University of Petroleum, Beijing	19
State Key Laboratory of Coal Mine Disaster Dynamics and Control	19
Chinese Academy of Sciences	18
National Science and Technology Infrastructure Program	17
China National Funds for Distinguished Young Scientists	16
China Geological Survey	14
Graduate Research and Innovation Projects of Jiangsu Province	14
China University of Geosciences, Beijing	13
Chongqing University	13
Christoffel Blinden Mission	13
Commonwealth Scientific and Industrial Research Organisation	13
Department of Education, Xinjiang Uygur Autonomous Region	13

Full list in file: Scopus-1699-Analyze-FundingSponsor.csv on figshare

Table 26. Main sources of publications

SOURCE TITLE	N
Journal Of Natural Gas Science And Engineering	186
Fuel	166
International Journal Of Coal Geology	126
Journal Of Petroleum Science And Engineering	93
Energy And Fuels	66
Energies	39
Energy Exploration And Exploitation	35
Energy Sources Part A Recovery Utilization And Environmental Effects	28
Transport In Porous Media	22
Arabian Journal Of Geosciences	18
Environmental Earth Sciences	17
International Journal Of Mining Science And Technology	15
International Journal Of Oil Gas And Coal Technology	15
Powder Technology	15
Journal Of Geophysics And Engineering	14
Natural Gas Industry B	14
Rock Mechanics And Rock Engineering	14
Marine And Petroleum Geology	12

SOURCE TITLE	N
Journal Of Mining Science	11
Energy	10
Australian Journal Of Earth Sciences	9
Journal Of Mines Metals And Fuels	9
Petroleum Exploration And Development	9
Acta Geologica Sinica	8
Energy Science And Engineering	8
Greenhouse Gases Science And Technology	8
Journal Of Co2 Utilization	8
Journal Of Water Process Engineering	8
Petroleum Science	8
Chemical Engineering Transactions	7

Full list in file: Scopus-1699-Analyze-Source.csv on figshare

Table 27. Subject areas of 1699 publications

SUBJECT AREA	
Energy	941
Earth and Planetary Sciences	592
Chemical Engineering	429
Environmental Science	298
Chemistry	270
Engineering	241
Agricultural and Biological Sciences	71
Mathematics	65
Social Sciences	62
Materials Science	58
Physics and Astronomy	58
Biochemistry, Genetics and Molecular Biology	42
Multidisciplinary	23
Computer Science	19
Medicine	19
Immunology and Microbiology	14
Business, Management and Accounting	11
Economics, Econometrics and Finance	6
Decision Sciences	4
Pharmacology, Toxicology and Pharmaceutics	2
Psychology	2
Arts and Humanities	1
Neuroscience	1

Table 28. Terms from Scopus index keywords meet more than 30 times (query: (TITLE-ABS-KEY("Coal bed Methane" OR "Coalbed Methane" OR "coal seam gas"))

Coal deposits	1251	Bituminous coal	80	Computerized tomography	51	Computer simulation	37
Methane	1124	Scanning electron microscopy	78	Deformation	51	Cracks	37
Coal bed methane	950	Carbon	75	Fractal dimension	51	Moisture	37
Coal	928	Coalbed methane reservoir	75	Greenhouse gases	51	Nitrogen	37
Firedamp	434	porosity	75	experimental study	51	concentration (composition)	37

coalbed methane	363	Petroleum reservoirs	74	Enhanced coalbed methane recoveries	48	Porous materials	36
Gases	322	Article	73	Flow of fluids	48	desorption	36
coal seam	272	Boreholes	73	hydraulic fracturing	48	Shale gas	35
Carbon dioxide	224	Pore size	73	Forecasting	47	Gas industry	34
Natural gas wells	222	Extraction	71	Ordos Basin	47	Horizontal wells	34
Petroleum reservoir engineering	198	gas production	70	Shanxi	47	Mercury intrusion porosimetry	34
Fracture	196	Temperature	69	coal mining	46	Metamorphic rocks	34
Coal mines	185	adsorption	68	Fracturing fluids	45	Petroleum deposits	34
China	170	Coal permeabilities	67	Geology	45	carbon sequestration	34
Metal recovery	162	Coal storage	62	Numerical methods	45	Productivity	33
Mechanical permeability	157	Diffusion	62	Two phase flow	45	Rocks	33
permeability	152	Nuclear magnetic resonance	62	Permeability evolution	44	Southern qinshui basins	33
Adsorption	144	Anthracite	60	Qinshui Basin	43	gas flow	33
methane	141	carbon dioxide	60	coal mine	43	shale gas	33
Gas permeability	139	Coalbed methane production	58	Hydrogeology	42	Adsorption and desorptions	32
Australia	137	Numerical models	58	Low permeability reservoirs	42	Efficiency	32
coal	125	natural gas	58	Microporosity	41	Methanation	32
Porosity	112	Adsorption capacities	57	Recovery	41	New South Wales	32
Desorption	109	Queensland	57	Aquifers	40	Underground coal mine	32
Gas adsorption	109	Seepage	55	Drainage	40	Coal seams	31
Hydraulic fracturing	109	Coal bed methane wells	54	Isotopes	40	hydrocarbon exploration	31
Flow of gases	89	Coalbed methanes	54	United States	40	Adsorption isotherms	30
hydrocarbon reservoir	88	Shale	54	Energy resources	39	Anisotropy	30
Groundwater	86	numerical model	54	Gas emissions	38	Coalbeds	30
Pore structure	85	Stresses	52	Reservoirs (water)	38	Gas content	30

Funding: The state contract #AAAA-A19-119022890063-9 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.

Mastalerz, M. (2014). *Coal Bed Methane. Future Energy, 145–158.* doi:10.1016/b978-0-08-099424-6.00007-7

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