

# Petroleum Geology of the Volga-Ural Province as Foreland basin, Determination of Bibliometric Research Landscape for Similar Regions

Is "Foreland basin" correct term for description of Volga-Ural region?

Search request in GOOGLE

"Foreland basin" Volga-Ural - Results: approximately 3 160 "Foredeep basin" Volga-Ural - Results: approximately 531 "Foreland" Volga-Ural - Results: approximately 8 770 "Foredeep" Volga-Ural - Results: approximately 4 820 **Remark:** Terms "Foreland basin" and "Foredeep basin" are context-related to the Volga-Ural region and represent an adequate query for advanced search for similar regions "Foreland basin" - Results: approximately 485 000 "Foredeep basin" - Results: approximately 36 900 "Foredeep field" - Results: approximately 230 "Foreland field" - Results: approximately 2 860 "Foreland Provinces" - Results: approximately 1 100 "Giant" "Foreland basin" Volga-Ural - Results: approximately 1 580 ("Giant" is too strong filter) "Giant" "Foredeep basin" Volga-Ural Results: approximately 282 "large" "Foreland basin" Volga-Ural - Results: approximately 3 360 "large" "Foredeep basin" Volga-Ural - Results: approximately 469 (large is too common word)

**Search request in OnePetro** Your search for "Foreland basin" volga-ural has returned 1 results Your search for "Foreland basin" has returned 568 results Your search for "Foredeep basin" volga-ural has returned 1 results Your search for "Foredeep basin" has returned 50 results **Remark:** "Foreland basin" >= 10 times more then "Foredeep basin" Your search for "Giant" "Foreland basin" has returned 95 results Your search for "Giant" "Foredeep basin" has returned 11 results Your search for ("Foreland basin") OR ("Foredeep basin") has returned 600 results - correct result Your search for Foreland basin has returned 948 results Your search for (Foreland OR Foredeep) AND basin has returned 1 062 results

**SPe search** <https://search.spe.org/2kweb/SPe/search?filters=&sort=score+desc&q=%22Foreland+basin%22-546+results> <https://search.spe.org/2kweb/SPe/search?filters=&sort=score+desc&q=%22Foredeep+basin%22-448+results> ("Foredeep basin") OR ("Foreland basin") - 15 results <https://doi.org/10.3133/sim3422> Traps in nearly all hydrocarbon accumulations of these petroleum systems are mainly structural and were formed by one or more mechanisms. These trap-forming mechanisms were mainly periodic halokinesis of the thick Cambrian Ara Salt and consequent folding and faulting from basin loading, rifting, or other major tectonic events, particularly those events forming the Oman Mountains and associated foreland-basin system during the Late Cretaceous and Late Tertiary. Many of the future new-field targets will likely be low-relief, subtle structures, as many of the large structures have been drilled. Ghaba salt basin province and Fahud salt basin province, Oman; Geological overview and total petroleum systems Open-File Report 99-50-D By: R.M. Pollastro <https://doi.org/10.3133/ofr99500> The Raton Basin is a foreland basin that formed immediately eastward of the Sangre de Cristo Mountains during their initial uplift, in the Late Cretaceous through early Eocene Laramide orogeny. Subsequently, these mountains have been extensively modified during formation of the Rio Grande rift, from late Oligocene to present.

**For translation to Russian:** <https://translate.academic.ru/foreland/en/>

**Definitions:**

[https://en.wikipedia.org/wiki/Foreland\\_basin](https://en.wikipedia.org/wiki/Foreland_basin) A foreland basin is a structural basin that develops adjacent and parallel to a mountain belt. Foreland basins form because the immense mass created by crustal thickening associated with the evolution of a mountain belt causes the lithosphere to bend, by a process known as lithospheric flexure. <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/foreland-basin> Foreland basins can be conveniently divided into fore-foreland/platform megasequences and one or more foreland basin megasequences that are separated from the former by a basal foreland basin unconformity. The greatest thickness of foreland basin sediments borders the fold-thrust belt, reflecting enhanced subsidence caused by thrust-sheet loading and deposition of sediments. Another characteristic of retroarc foreland basins is that the proximal basin margin progressively becomes involved with the propagating fold-thrust belt. Progressive unroofing in the fold-thrust belt should lead to an inverse stratigraphic sampling of the source in foreland basin sediments. A key element in foreland basin development is the syntectonic character of the sediments. The greatest thickness of foreland basin sediments borders the fold-thrust belt reflecting enhanced subsidence caused by thrust-sheet loading and deposition of sediments. Foreland basins such as the Alberta basin and Alpine and Apennines foredeeps (Fig. 1.10: Oman mountains; Fig. 2.4: Alpine molasse and Po basins) are associated with continental collision and formed by flexure of the lithosphere. Forelope areas of foreland basins usually spread extensively, with a gentle gradient. This is favorable to the development of large-scale depositional systems, laying the foundation for oil and gas accumulation in large-sized stratigraphic or extensive continuous reservoirs. The Permian Foreland Basin TPS was defined to include Permian (Asselian to Artinskian) deep-water, organic-rich mudstone source rocks. One AU was defined for the Permian Foreland Basin TPS at Permian Reefs/Thrust Folds TPS. Reservoirs in this AU include Permian carbonate reefs and clastic rocks having evaporite seals, primarily the Lower Permian (Kungurian) evaporite. Known traps are reefs and structures associated with thrust faults and folding. <https://pubs.usgs.gov/ofr/2010/3095/pdf/F510-3095.pdf>

The southern Pre-Uralian Foredeep and the northeastern Pre-Caspian Basin of southern Russia and Kazakhstan are at the juncture of two major oil-producing regions, the Volga-Ural Basin and the new fields of the Northern Caspian Basin (e.g., Tengiz). The southern Pre-Uralian Foredeep has produced little oil; nevertheless, the Permian-Carboniferous stratigraphy and the general fold-thrust structure of the Pre-Uralian Foredeep, and adjacent Pre-Caspian Basin, afford the possibility for classic and largely untested sub-salt and sub-thrust plays. Snyder, W. S., Spinosa, C., Davydov, V. I., & Belasky, P. (1994). Petroleum Geology of the Southern Pre-Uralian Foredeep with Reference to the Northeastern Pre-Caspian Basin. International Geology Review, 36(5), 452-472. doi:10.1080/00206819409465471 The Vikitskii Basin is a separate petroleum province that lies beneath the continental shelf of the East Siberian Sea east of the New Siberian Islands and northwest of Wrangel Island. It is a basin known only on the basis of gravity data and three seismic profiles. A small, southern part of the basin overlies the Brooks Range-Chukotka late Mesozoic-early Paleogene orogenic belt, but most of the basin lies north of that belt. Its regional setting suggests that it may have similarities to other post-orogenic (successor) basins on the East Siberian Shelf as well as to foreland, rift-sag, and passive margin basins lying north of the orogenic belt such as the North Slope, North Chukchi and Podvodnikov Basins. Bird, K.J., Houseknecht, D.W., and Pitman, J.K., 2019, Geology and assessment of undiscovered oil and gas resources of the Vikitskii Basin Province, 2008, chap. Z of Moore, T.E., and Gautier, D.L., eds., The 2008 Circum-Arctic Resource Appraisal: U.S. Geological Survey Professional Paper 1824, 12 p., <https://doi.org/10.3133/pp18247>. The Bighorn Basin is one of many structural and sedimentary basins that formed in the Rocky Mountain foreland during the Laramide orogeny. The basin is nearly 180 miles long, 100 miles wide, and encompasses about 10,400 square miles in northern Wyoming and southern Montana. The basin is bounded by major basement uplifts that include the Pryor uplift on the northeast, the Beartooth uplift on the northwest, the Bighorn uplift on the east, and the Owl Creek uplift on the south. The northern margin includes a zone of faulting and folding referred to as the Nye-Bowler Inseament. The western margin is formed by volcanic rocks of the Absaroka Range. Finn, T.M., 2019, Stratigraphic cross sections of the Niobrara Interval of the Upper Cretaceous Cody Shale in the Bighorn Basin, Wyoming and Montana: U.S. Geological Survey Scientific Investigations Map 3422, pamphlet 19 p., 1 sheet [cross section]. <https://doi.org/10.3133/sim3422> Traps in nearly all hydrocarbon accumulations of these petroleum systems are mainly structural and were formed by one or more mechanisms. These trap-forming mechanisms were mainly periodic halokinesis of the thick Cambrian Ara Salt and consequent folding and faulting from basin loading, rifting, or other major tectonic events, particularly those events forming the Oman Mountains and associated foreland-basin system during the Late Cretaceous and Late Tertiary. Many of the future new-field targets will likely be low-relief, subtle structures, as many of the large structures have been drilled. Ghaba salt basin province and Fahud salt basin province, Oman; Geological overview and total petroleum systems Open-File Report 99-50-D By: R.M. Pollastro <https://doi.org/10.3133/ofr99500> The Raton Basin is a foreland basin that formed immediately eastward of the Sangre de Cristo Mountains during their initial uplift, in the Late Cretaceous through early Eocene Laramide orogeny. Subsequently, these mountains have been extensively modified during formation of the Rio Grande rift, from late Oligocene to present.

The Raton Basin lies to the east of the Culebra segment of the Sangre de Cristo Mountains. This foreland basin formed during, and is related to, the original uplift of the Sangre de Cristo Mountains which was driven by tectonic contraction of the Laramide (about 70 Ma to about 40 Ma) orogeny. Renewed uplift and structural modification of these mountains has occurred during formation of the Rio Grande rift. Surficial deposits in the study area include alluvial, mass-movement, and glacial deposits of middle Pleistocene to Holocene age. [https://www.usgs.gov/centers/ercs/science/world-oil-and-gas-resource-assessments?qt-science\\_center\\_object=tsc04qt-science\\_center\\_objects](https://www.usgs.gov/centers/ercs/science/world-oil-and-gas-resource-assessments?qt-science_center_object=tsc04qt-science_center_objects) - World Oil and Gas Resource Assessments

**Foredeep translation to Russian:** <https://translate.academic.ru/foredeep/en/en/xx/>

## Scopus 04-06-2-19

**Picking up query**

TITLE=ABS-KEY ( foreland AND basins ) - 7,566 document results

TITLE=ABS-KEY ( foreland AND basin\* ) - 7,600 document results

TITLE=ABS-KEY ( "foreland basin\*" ) - 5,587 document results Article (5,086)

Conference Paper (211)

**Remark:** Using only articles we get more consistent results

TITLE=ABS-KEY ( "foreland basin\*" ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) - only Articles - 5,086 document results TITLE=ABS-KEY ( "foreland basin\*" ) AND ( oil OR gas OR petroleum OR hydrocarbon ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) - 3,399 document results TITLE=ABS-KEY ( "foreland basin" OR "foredeep basin" ) AND ( oil OR gas OR petroleum OR hydrocarbon ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) - 3,566 document results

**Remark:**

- adding foredeep do not dramatically change results
- more than half "foreland basin\*" are connected with ( oil OR gas OR petroleum OR hydrocarbon ) (5,086 vs 3,399)

**Last 10 years** TITLE=ABS-KEY ( "foreland basin" OR "foredeep basin" ) AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) - 1,711 document results\*

- English (1,415)
- Chinese (269)
- Spanish (34)
- German (5)

**Remark:** We'll be using only English for further analysis TITLE=ABS-KEY ( "foreland basin\*" OR "foredeep basin" ) AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) - 1,415 document results **1,415 documents will be used for further analysis**

**Table 1.** Analyze: Top 20 Affiliations from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-Affiliation.csv)

AFFILIATION	Number of results
Consejo Nacional de Investigaciones Cientificas y Técnicas	56
Universidad de Buenos Aires	55
University of Texas at Austin	55
CNRS Centre National de la Recherche Scientifique	54
Chinese Academy of Sciences	53
University of Arizona	50
Ministry of Education China	39
Research Institute of Petroleum Exploration and Development	39
China University of Petroleum - Beijing	36
Universitat de Barcelona	28
TOTAL S.A.	28
Consiglio Nazionale delle Ricerche	28
Nanjing University	28
Institute of Geology, Chinese Academy of Geological Sciences	27
China University of Geosciences, Beijing	26
Institute of Geology and Geophysics Chinese Academy of Sciences	25
Consejo Superior de Investigaciones Cientificas	24
University of Calgary	23
CSIC - Instituto de Ciencias de la Tierra Jaume Almera ICTJA	23
Chinese Academy of Geological Sciences	23
Sorbonne Universite	22
China University of Geosciences, Wuhan	22

**Table 2.** Analyze: Top 20 Authors from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-Author.csv)

AUTHOR NAME	Number of results
Horton, B.K.	25
Ramos, V.A.	23
Sachsenhofer, R.F.	21
Folguera, A.	18
Stockli, D.F.	18
Gehrels, G.E.	17
Carrapa, B.	15
Mora, A.	13
Vergés, J.	13
Graham, S.A.	12
Gratzer, R.	11
Linzer, H.G.	11
Bechtel, A.	10
Sinclair, H.D.	10
Gross, D.	9
Hadlari, T.	9
Harzhauser, M.	9
Hubbard, S.M.	9
Parra, M.	9
Saylor, J.E.	9
Baby, P.	8
Callot, J.P.	8

**Table 3.** Analyze: Top 20 Countries from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-Country.csv)

COUNTRY/TERRITORY	Number of results
United States	337
China	237
Italy	143
France	138
United Kingdom	112
Argentina	108
Canada	103
Spain	103
Germany	100
India	75
Australia	70
Norway	50
Austria	49
Poland	48
Switzerland	44
Netherlands	39
Iran	35
Brazil	34
Colombia	27
Turkey	26
Iraq	22
Russian Federation	18

**Remark:** Number of Russian publications in English are less then from India, Poland, Iran, Colombia and Iraq

**Table 4.** Analyze: Top 20 Funding/Sponsors from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-FundingSponsor.csv)

Funding/Sponsors	Number of results
National Natural Science Foundation of China	83
National Science Foundation	34
National Basic Research Program of China (973 Program)	22
Natural Sciences and Engineering Research Council of Canada	21
Consejo Nacional de Investigaciones Cientificas y Técnicas	19
National Science Foundation (NSF)	19
Chinese Academy of Sciences	16
American Association of Petroleum Geologists	15
National Natural Science Foundation of China (NSFC)	11
Agence Nationale de la Recherche	9
China National Critical Project for Science and Technology on Water Pollution Prevention and Control	9
Fundamental Research Funds for the Central Universities	9
Agencia Nacional de Promoción Científica y Tecnológica	8
Natural Environment Research Council (NERC)	8
Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung	8
University of Texas at Austin	8
Australian Research Council	7
China Geological Survey	7
Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)	7
Deutsche Forschungsgemeinschaft	7
Geological Society of America	7
National Major Science and Technology Projects of China	7
PetroChina Company Limited	7
American Chemical Society Petroleum Research Fund	6
Ministerio de Economía y Competitividad	6
National Aerospace Science Foundation of China	6

**Table 5.** Analyze: Top 20 Sources from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-Source.csv)

SOURCE TITLE	Number of results
Tectonophysics	79
Basin Research	71
Marine And Petroleum Geology	69
Tectonics	58
Journal Of Asian Earth Sciences	52
Sedimentary Geology	49
Bulletin Of The Geological Society Of America	46
Journal Of South American Earth Sciences	37
Journal Of Sedimentary Research	36
Palaeogeography Palaeoclimatology Palaeoecology	33
Geological Society Special Publication	28
AAPG Bulletin	26
Arabian Journal Of Geosciences	25
Sedimentology	24
Earth And Planetary Science Letters	23
Geological Magazine	21
Geological Journal	20
Geological Quarterly	20
International Journal Of Earth Sciences	20
Acta Geologica Sinica	18
Journal Of Structural Geology	17
Petroleum Exploration And Development	17

**Table 6.** Analyze: Top 20 Subjects from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-Subject.csv)

SUBJECT AREA	Number of results
Earth and Planetary Sciences	1375
Energy	108
Environmental Science	103
Agricultural and Biological Sciences	71
Engineering	36
Social Sciences	14
Biochemistry, Genetics and Molecular Biology	6
Multidisciplinary	6
Chemical Engineering	5
Physics and Astronomy	5
Arts and Humanities	4
Mathematics	4
Immunology and Microbiology	3
Business, Management and Accounting	2
Chemistry	2
Computer Science	2
Materials Science	1
Medicine	1
Pharmacology, Toxicology and Pharmaceuticals	1

**Table 7.** Analyze: Top 10 Years from query: (TITLE=ABS-KEY("foreland basin" OR "foredeep basin") AND ( oil OR gas OR petroleum OR hydrocarbon ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( DOCTYPE,"ar" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) ) (more results in file: Scopus-1415-Analyze-Year.csv)

YEAR	Number of results
2019	66
2018	169
2017	137
2016	156
2015	161
2014	158
2013	151
2012	152
2011	136
2010	129

**Remark:** no evident increase in publications by years

Results form the Tables as the Charts could be seen at this direct link: <https://figshare.com/s/90f4161d708b06887da4>

Using VOSviewer

**Table 7.** Top 40 Keywords (more results in file: KW\_co-occer-1415-docs.tsv)

keyword	occurrences	total link strength
foreland basin	981	14607
stratigraphy	325	5950
tectonics	307	5601
deformation	215	3516
basin evolution	209	3426
tectonic evolution	209	3394
miocene	196	3116
sedimentology	193	3509
uplift	181	3011
sandstone	178	3005
china	172	2562
orogeny	170	2890
geochronology	169	3224
provenance	167	2746
tectonic setting	165	2642
fold and thrust belt	163	2635
sedimentation	152	2394
cretaceous	151	2523
zircon	133	2621
depositional environment	129	1981
deposition	122	2016
united states	119	1935
argentina	107	1555
uranium-lead dating	105	1921
structural geology	104	1940
andes	103	1731
subsidence	102	1718
sequence stratigraphy	90	1329
cenozoic	86	1507
eocene	84	1298
italy	84	1387
oligocene	84	1419
silicate minerals	82	1914
detrital deposit	80	1468
faulting	79	1400
paleogeography	79	1329
alps	77	1187
forearc basin	71	1129
seismology	71	1248
deposits	70	1415



Fig.1 Keywords co-occurrence from 1415 bibliometric list. file:KW\_co-occer-1415-docs.png



Fig.2 Overlay of keywords co-occurrence from 1415 bibliometric list. file:KW\_co-occer-1415-docs-overlay.png

**Remark:** interest to zircon is growing. For more information see file: lens-scholarly-works-on-foreland.pdf

**Focusing on some clusters from Fig.1**

**Table 8.** Top 30 Keywords in cluster 1 (more results in file: KW\_co-occer-1415-docs-clusters-1.csv)



