U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

BIBLIOGRAPHY OF USGS MARINE ORGANIC GEOCHEMISTRY--1976-1995

Keith A. Kvenvolden[1]

Open-File Report 95-41

[1]Menlo Park, California 94025

1995

ABSTRACT

This bibliography lists the publications (194 reports and 103 abstracts) from the USGS Marine Organic Geochemistry program under eight topic areas: (1) Natural Gas Geochemistry, (2) Geochemistry of Gas Hydrate--Occurrence and Resource, (3) Geochemisty in Global Change, (4) Environmental Geochemistry, (5) Petroleum Geochemistry, (6) Geochemistry of Deep Ocean Drilling, (7) Amino-Acid Geochronology (Aminostratigraphy), and (8) Reviews and Reports. These publications serve as the basic record for this research.

INTRODUCTION

The year 1995 marks the 20th anniversary of the Marine Organic Geochemistry Program in the Branch of Pacific Marine Geology, U.S. Geological Survey. The program has implemented basic and applied research in organic geochemistry with particular emphasis on problems in marine geology. The purpose of the research has been to understand the occurrence, distribution, fate, and significance of organic matter in marine sediment and sedimentary rocks. Eight research areas have been investigated:

- Natural Gas Geochemistry
- Geochemistry of Gas Hydrates--Occurrence and Resource
- Geochemisty in Global Change
- Environmental Geochemistry
- Petroleum Geochemistry
- Geochemistry of Deep Ocean Drilling
- Amino-Acid Geochronology (Aminostratigraphy)
- Book Reviews and Reports

From these investigations have come publications, both Reports and Abstracts, which are chronologically listed here under each research area. Reports and Abstracts are given separately. The purpose of this bibliography is to record in one place, through the listing of published papers, the results of this twenty-year effort in marine organic geochemisty.

DISCUSSION

Natural Gas Geochemistry. The presence of natural gases in sediment and seeps has been studied to determine sources and processes of gas generation in offshore and onshore settings and to relate these occurrences to environmental

and resource considerations. Because of its importance, gas hydrate, a potential unconventional resource of natural gas, is discussed separately.

Geochemical studies investigated hydrocarbon gases in surface sediments offshore from (1) Alaska (Eastern and Western Gulf of Alaska, Bering Sea, and Beaufort Sea); (2) northern California (San Francisco Bay and Eel River Basin); (3) islands of the South Pacific Ocean (New Guinea, Solomon Islands, Vanuatu, and New Zealand); and (4) Antarctica (Wilkes Land Margin and Ross Sea). Gases in deep oceanic sediment have been investigated through the Deep Sea Drilling Project (DSDP) and the Ocean Drilling Program (ODP) in the Atlantic Ocean (offshore from southeastern U.S., and Norway) and in the Pacific Ocean (offshore from Central America, Peru, and Chile). Onshore natural gas seeps have been sampled and described in New Zealand and the western U.S. (Wyoming, Washington, and Oregon).

Results of these studies have shown that methane and the higher molecular weight hydrocarbon gases, ethane, ethene, propane, propene, and butanes, are very common in marine sediment. Both microbial and thermal sources of gases are present with occurrences of microbial hydrocarbon gas being observed more often than thermogenic hydrocarbon gases.

Geochemistry of Gas Hydrates--Occurrence and Resource. The worldwide occurrence of gas hydrate has been described, utilizing in part sampling by the DSDP and ODP. Gas hydrate samples have been recovered and analyzed from DSDP Leg 76 (offshore from southeastern U.S.) and Leg 84 (offshore from Costa Rica and Guatemala), and from ODP Leg 112 (offshore from Peru). In addition, gas hydrate has been sought in marine sediment of the Norwegian Sea (ODP Leg 104) and of the Peru-Chile Trench, offshore from Chile (ODP Leg 141).

Methane is the principal gas in natural gas hydrate; evidence thus far indicates that much of this methane originated from microbial sources. The widespread occurrence of gas hydrate in marine sediment suggests that methane is a major reservoir of organic carbon in the shallow geosphere. Methane in gas hydrate may be a potential unconventional energy resource, a geological hazard responsible for triggering submarine landslides, and a factor in global climate change because of the "greenhouse" properties of the methane released during hydrate dissociation. Papers in this bibliography dealing with gas hydrate and global change are included in the following section.

Geochemistry in Global Change. Permafrost and gas hydrate are considered to be sources of methane in global climate change according to the International Panel on Climate Change (IPCC). In our research, we have investigated methane in cores of discontinuous permafrost and in the atmosphere and walls of the Fox permafrost tunnel near Fairbanks, Alaska. Methane has been measured in water

and seasonal ice of the Beaufort Sea continental shelf as part of the search for methane released from dissociating gas hydrate during global change.

Permafrost contains varying concentrations of methane which can be released from melting permafrost during global warming. Although methane is present in water and seasonal ice of the Beaufort Sea continental shelf, it is still uncertain whether or not this methane is related to gas hydrate dissociation. In theory, gas hydrate should be a source of atmospheric methane during global warming.

Environmental Geochemistry. The occurrence in marine sediment of petroleum-like hydrocarbons from possible anthropogenic sources is an important environmental issue. Our research has considered mainly sediment in estuarine settings (Willapa Bay, San Francisco Bay, and Prince William Sound).

Our results have provided (1) a reassessment of the rates at which oil seeps into the marine environment, (2) an evalution of the modification of infaunal activity as a result of an oil spill, (3) a consideration of organic compounds as source discriminants and transport indicators in San Francisco Bay, and (4) a discovery that oil residues on beaches of Prince William Sound often have a source signature of oil products originating in California, indicating contamination from sources other than the *Exxon Valdez* oil spill or the natural background.

Petroleum Geochemistry. Occurences of conventional and unconventional petroleum have been investigated. Conventional petroleum geochemical studies have been directed to sediment offshore from Alaska, northern California, Chile, and Antarctica (Wilkes Land Margin, Ross Sea, Weddell Sea, and Prydz Bay) and to onshore sediment of the Olympic Peninsula of Washington. Unconventional hydrothermal petroleum from Escanaba Trough and the southern end of Gorda Ridge has been the subject of a number of reports.

Thermogenic hydrocarbons are present in Norton Basin of Alaska and in the Eel River Basin offshore from northern California. Potential petroleum source sediment was identified in the Weddell Sea of Antarctica. A preliminary assessment of source rock-crude oil correlation was made for the North Slope of Alaska, and a preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane on the west side of the Olympic Peninsula of Washington was undertaken.

Our studies suggest that hydrothermal petroleum in sediment of Escanaba Trough was formed "instantaneously", perhaps in the past 100 years, at temperatures near 350°C. Laboratory similations have tried to emulate the hydrothermal petroleum-forming process.

Geochemistry of Deep Ocean Drilling. This section lists miscellaneous reports that have been generated as a result of work done for DSDP and ODP.

These reports are often summaries and technical manuals concerning geochemistry in deep ocean drilling. DSDP and ODP reports that are concerned with hydrocarbon gases, gas hydrate, and petroleum are listed in sections dealing specifically with these subjects.

Amino-Acid Geochronology (Aminostratigraphy). This subject was investigated until about 1982 and involved the application of amino acid racemization techniques to problems of stratigraphic correlation and age assessment. The techniques were applied to amino acids in shells, bone, wood, and marine and lacustrine sediment. Age assessments were made for marine terrace deposits and glacial-marine sediment from the west coast of the conterminous U.S. and Alaska.

Amino-acid dating was applicable for organic samples spanning the past two million years and particularly for marine mollusks of the late Pleistocene. The methods were useful in relative age determinations but could not be used with confidence for absolute age assessment.

Book Reviews and Reports. This section lists mainly invited reviews of books devoted to aspects of organic geochemistry.

OUTLINE OF BIBLIOGRAPHY (Reports)

OUTLINE OF BIBLIOGRAPHY (Abstracts)

SUMMARY

During the past 20 years (1976-1995) the USGS Marine Organic Geochemistry program in the Branch of Pacific Marine Geology has produced a total of 297 reports and abstracts dealing with various aspects of organic geochemistry as applied to the marine environment. The majority of papers have dealt with the geochemistry of natural hydrocarbon gases with particular attention focused on natural gas hydrate. The second major subject area has been petroleum geochemistry, particularly hydrothermal petroleum, and some environmental aspects of petroleum in modern marine sediment.

BIBLIOGRAPHY OF USGS MARINE ORGANIC GEOCHEMISTRY
Reports

Natural Gas Geochemistry

Nelson, C. H., Kvenvolden, K. A., and Clukey, E. C., **1978**, Thermogenic gases in near-surface sediments of Norton Sound, Alaska: Offshore Technology Conference, OTC 3354, p. 2623-2633.

Cooper, A. K., Scholl, D. W., Marlow, M. S., Childs, J. R., Redden, G. D., and Kvenvolden, K. A., **1978**, The Aleutian Basin, Bering Sea - A frontier area for hydrocarbon exploration: Offshore Technology Conference, OTC 3089, p. 353-362.

Kvenvolden, K. A., Nelson, C. H., Thor, D. R., Larsen, M. C., Redden, G. D., Rapp, J. B., and Des Marais, D. J., **1979**, Biogenic and thermogenic gas in gas-charged sediment of Norton Sound, Alaska: Offshore Technology Conference, OTC 3412, p. 479-486.

Kvenvolden, K. A., Weliky, K., Nelson, C. H., and Des Marais, D. J., **1979**, Submarine carbon dioxide seep in Norton Sound, Alaska: Science, v. 205, p. 1264-1266.

Cooper, A. K., Scholl, D. W., Marlow, M. S., Childs, J. R., Redden, G. D., Kvenvolden, K. A., and Stevenson, A. J., **1979,** Hydrocarbon potential of Aleutian Basin, Bering Sea: Am. Assoc. Petroleum Geologists Bull., v. 63, p. 2070-2087.

Gardner, J. V., Vallier, T. L., Dean, W. E., Kvenvolden, K. A., and Redden, G. D., **1979**, Sedimentology and geochemistry of surface sediments and the distribution of faults and potentially unstable sediments, St. George region of the Outer Continental Shelf, southern Bering Sea: U.S. Geological Survey Open-File Report 79-1562, 88 p.

Nelson, H., Thor, D.R., Sandstrom, M.W., and Kvenvolden, K.A., **1979**, Modern biogenic gas-generated craters (sea-floor "pockmarks") on the Bering Shelf, Alaska: Geological Society of America Bulletin, Part I, v. 90., p. 1144-1152.

Kvenvolden, K. A., and Redden, G. D., **1980**, Hydrocarbon gas in sediment from the shelf, slope, and basin of the Bering Sea: Geochimica et Cosmochimica Acta, v. 44, p. 1145-1150.

Kvenvolden, K. A., Redden, G. D., Thor, D. R., and Nelson, C. H., **1981**, Hydrocarbon gases in near-surface sediment of northern Bering Sea: *in*: Hood, D. W. and Calder, J. A., eds., The Eastern Bering Sea Shelf: Oceanography and Resources, v. 1, U.S. Dept. of Commerce, p. 411-424.

Kvenvolden, K. A., Vogel, T. M., and Gardner, J. V., **1981**, Geochemical prospecting for hydrocarbons in the outer continental shelf, southern Bering Sea, Alaska: Journal of Geochemical Exploration, v. 14, p. 209-219.

Vogel, T. M., Oremland, R. S., and Kvenvolden, K. A., **1981**, Low-temperature formation of C_{1-4} alkanes in an estuarine sediment: Chemical Geology., v. 37, p. 289-298.

Hampton, M. A., and Kvenvolden, K. A., **1981**, Geology and geochemistry of gas-charged sediment in the Kodiak Shelf, Alaska: Geo-Marine Letters, v. 1, p. 141-147.

Vogel, T.M., and Kvenvolden, K.A., **1981**, Hydrocarbon gases in Navarin Basin province sediments: *in* Carlson, P.R., and Karl, H.A., Seafloor Geologic Hazards, Sedimentology, and Bathymetry: Navarin Basin Province, Northwestern Bering Sea: U.S. Geological Survey Open-File Report 81-1217, p. 80-99.

Kvenvolden, K.A., and Rapp, J.B., **1981**, Hydrocarbon gas in sediments, offshore Oregon, *in* Clarke, S.H., Field, M.E., and Hirosawa, C.A., Reconnaissance Geology and Geologic Hazards of Offshore Coos Bay Basin, Central Oregon Continental Margin: U.S. Geological Survey Open-File Report 81-898, Appendix A, p. 77-82.

Galimov, E. M., and Kvenvolden, K. A., **1983**, Concentrations and carbon isotopic compositions of CH_4 and CO_2 in gas from sediments of the Blake Outer Ridge, Deep Sea Drilling Project Leg 76, *in* Sheridan, R. E., Gradstein, F. et al., Initial Reports Deep Sea Drilling Project, v. 76 Washington (U.S.Govt. Printing Office), p. 403-407.

Brooks, J. M., Barnard, L. A., Wiesenburg, D. A., Kennicutt, M. C., and Kvenvolden, K. A., **1983**, Molecular and isotopic compositions of hydrocarbons at Site 533, Deep Sea Drilling Project Leg 76, *in* Sheridan, R. E., Gradstein, F., et al., Initial Reports Deep Sea Drilling Project, v. 76, Washington (U.S. Govt. Printing Office), p. 377-389.

Claypool, G.E., and Kvenvolden, K.A., **1983**, Methane and other hydrocarbon gases in marine sediment: Annual Reviews in Earth and Planetary Sciences, v. 11, p. 299-327.

Golan-Bac, M., and Kvenvolden, K.A., **1983**, Hydrocarbon gases in sediments -- results from 1981 field season: *in* Karl, H.A., and Carlson, P.R., eds., Surface and Near-surface Geology, Navarin Basin Province: Results of the 1980-81 Field Season. U.S. Geological Survey Open-File Report 84-89, Chapter 8, p. 55-75

Morton, J.L., Eaby, J.S., Normark, W.R., Eissen, J.P., Golan-Bac, M., Rapp, J.B., and Beon, J.M., **1983**, Basalt samples and water-column samples from the southern Juan de Fuca Ridge: Preliminary results of cruise L 13-82-WF: U.S. Geological Survey Open-File Report 83-827, 12 p.

Golan-Bac, M., and Kvenvolden, K.A., **1983**, Methane in sediments of the eastern Gulf of Alaska, *in* Lee, H.J., and Schwab, W.C., Geotechnical Framework, Northeast Gulf of Alaska: U.S. Geological Survey Open-File Report 83-499, Appendix A, p. 108-111.

Golan-Bac, M., and Kvenvolden, K.A., **1984**, Hydrocarbon gases in sediments from Navarin Basin, Bering Sea -- results from 1982 field season: U.S. Geological Survey Open-File Report 84-97, 11 p.

Kvenvolden, K.A., and von Huene, R., **1984**, Potential for generation of natural gas in sediments of the convergent margin of the Aleutian Trench Area: U.S. Geological Survey Open-File Report 84-404, 76 p.

Jeffrey, A.W.A., Pflaum, R.C. McDonald, T.J., Brooks, J.M., and Kvenvolden, K.A., **1985**, Isotopic analysis of core gases at Sites 565-570, DSDP Leg 84: *in* von Huene, R., Aubouin, J., et al., Initial Reports Deep Sea Drilling Project, v. 84: Washington (U.S. Gov't Printing Office), p. 719-726.

Carlson, P.R., Golan-Bac, M., Karl, H.A., and Kvenvolden, K.A., **1985**, Seismic and geochemical evidence for shallow gas in the sediment on the Navarin continental margin, Bering Sea: American Association of Petroleum Geologist Bull., v. 69, p. 422-436.

Kvenvolden, K.A., and von Huene, R., **1985**, Natural gas generation in sediments of the convergent margin of the eastern Aleutian Trench area: *in* Howell, D.G., ed., Tectonostratigraphic Terranes of the Circum-Pacific Region: Circum-Pacific Council for Energy and Minerals, Earth Science Series, No. 1, p. 31-49.

Claypool, G.E., Vuletich, A.K., and Kvenvolden, K.A., **1985**, Isotopic composition of interstitial fluids in sediment of the Nankai Trough, Deep Sea Drilling Project Leg 87: *in* Kagami, H., Karig, D.E., Coulbourn, et al., Initial Reports Deep Sea Drilling Project, v. 87, Washington (U.S. Govt. Printing Office), 857-860.

Golan-Bac, M., and Kvenvolden, K.A., **1986**, Hydrocarbon gases in surface sediments of the South Aoba Basin, Vanuatu, *in* Greene, H.G., and Wong, F.L., eds., Geology and offshore resources of Pacific island arcs -- Vanuatu Region: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 8, p. 275-278.

Kvenvolden, K.A., Golan-Bac, M., and Rapp, J.B., **1987**, Hydrocarbon geochemistry of sediments offshore from Antarctica: Wilkes Land Continental Margin: *in* Eittreim, S.L., and Hampton, M.A., eds., The Antarctic Continental Margin: Geology and Geophysics of Offshore Wilkes Land: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 5A, p. 205-213.

Rapp, J.B., Kvenvolden, K.A., and Golan-Bac, M., **1987**, Hydrocarbon geochemistry of sediments offshore from Antarctica, *in* Cooper, A.K., and Davey, F.J., eds., The Antarctic Continental Margin: Geology and Geophysics of the Western Ross Sea: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, No. 5B, p. 217-230.

Kvenvolden, K.A., and Golan-Bac, M., **1987**, Methane and other hydrocarbon gases in sediments of the southern Pacific Ocean: U.S. Geological Survey Open-File Report 87-401, 23 p.

Field, M.E., and Kvenvolden, K.A., **1987**, Preliminary report on gaseous hydrocarbons in sediment and seeps, offshore Eel River Basin, California, *in* Schymiczck, H., and Suchsland, R., eds., Tectonics, Sedimentation and Evolution of the Eel River Basin and Associated Coastal Basins of Northern California: Miscellaneous Publication No. 37, San Joaquin Geological Society, Bakersfield, California, p. 55-60.

Kvenvolden, K.A., Golan-Bac, M., and Snavely, P.D., Jr., **1988**, Preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane, west side of the Olympic Peninsula, Washington: Part 3, Composition of natural gases in seeps, outcrops, and a test well: U.S. Geological Survey Open-File Report 88-75, p. 50-62.

Evans, W.C., White, L.D., and Rapp, J.B., **1988**, Geochemistry of some gases in hydrothermal fluids from the southern Juan de Fuca Ridge: Journal of Geophysical Research, v. 93, n. B12, p. 15305-15313.

Kvenvolden, K.A., **1988**, Hydrocarbon gas in bottom sediment from offshore the northern islands of Papua, New Guinea, *in* Marlow, M.S., Dadisman, S.V., and Exon, N.F., eds., Geology and Offshore Resources of Pacific Island Arcs - New Ireland and Manus Region, Papua, New Guinea: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 9, p. 157-160.

Kvenvolden, K.A., **1988**, Hydrocarbon gas in sediment of the southern Pacific Ocean: Geo-Marine Letters, v. 8, p. 179-187.

Kvenvolden, K.A., Simoneit, B.R.T., and Love, J.D., **1989**, Chemical and isotopic compositions of natural gas from seeps in Yellowstone and Grand Teton National Parks, Wyoming: Fortieth Field Conference, Wyoming Geological Association Guidebook, p. 241-246.

Kvenvolden, K.A., Golan-Bac, M., McDonald, T.J., Pflaum, R.C., and Brooks, J.M., **1989**, Hydrocarbon gases in sediment of the Vøring Plateau, Norwegian Sea: *in* Eldholm O., Thiede, J., Taylor, E., et al., Proceedings Ocean Drilling Program, Scientific Results, 104: College Station, TX (Ocean Drilling Program), p. 319-326.

Kvenvolden, K.A., and Pettinga, J.A., **1989**, Hydrocarbon gas seeps of the convergent Hikurangi margin, North Island, New Zealand: Marine and Petroleum Geology, v. 6, p. 2-8.

Kvenvolden, K.A., and Niem, A., **1989**, Hydrocarbon gases in sediments of the Solomon Islands area, *in* Vedder, J.G., and Bruns, T.R., eds., Geology and Offshore Resources of Pacific Island arcs--Solomon Islands and Bougainville, Papua New Guinea Regions: Houston, Texas, Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 12, p. 283-286.

Kvenvolden, K.A., Golan-Bac, M., and Snavely P.D., Jr., **1989**, Preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane, west side of the Olympic Peninsula, Washington: C. Composition of natural gases in seeps, outcrops, and a test well: U.S. Geological Survey Bulletin 1892, p. 39-45.

Kvenvolden, K.A., Frank, T.J., and Bac, M.G., **1990**, Hydrocarbon gases in Tertiary and Quaternary sediment offshore Peru--Results and comparisons: *in* Suess, E., von Huene, R., et al., Proceedings Ocean Drilling Program, Scientific Results, 112: College Station, Texas (Ocean Drilling Program), p. 505-515.

Kvenvolden, K.A., **1990**, Natural gas: The Petroleum System--Status of research and methods, 1990: U.S. Geological Survey Bulletin 1912, p. 69-71.

Lorenson, T.D., Kvenvolden, K.A., Simoneit, B.R.T., and Leif, R.N., **1991**, Composition of gas seeps in northwestern Wyoming: U.S. Geological Survey Open-File Report 91-121, 35 p.

Lorenson, T.D., and Kvenvolden, K.A., **1993**, Hydrocarbon gases from natural sources in the northwestern U.S.: *in* Howell, D.G., ed., Future of Energy Gases, USGS Prof. Paper 1570, p. 453-470.

Wiese, K., and Kvenvolden, K.A., **1993**, Introduction to microbial and thermal methane: *in* Howell, D.G., ed., The Future of Energy Gases, USGS Prof. Paper 1570, 13-20.

Geochemistry of Gas Hydrates--Occurrence and Resource

Kvenvolden, K. A., and McMenamin, M. A., **1980**, Hydrates of natural gas: a review of their geologic occurrence: U.S. Geological Survey Circular 825, 11 p.

Barnard, L. A., Kvenvolden, K. A., Wiesenburg, D. A., and Brooks, J.M., **1981**, Geochemistry of a marine gas hydrate associated with a bottom-simulating reflector: American Association of Petroleum Geologists Bulletin, v. 65, p. 894-895.

Kvenvolden, K. A., Barnard, L. A., Brooks, J. M., and Wiesenburg, D.A., **1982**, Geochemistry of natural gas hydrates in oceanic sediment: *in* Bjorøy, M., ed., Advances in Organic Geochemistry 1981, Wiley, London, p. 422-430.

Kvenvolden, K. A., **1982**, Occurrence and origin of marine gas hydrates: The Roger J. E. Brown Memorial Volume, Proceedings 4th International Permafrost Conf., 1981, National Research Council of Canada, Ottawa, p. 305-311.

Kvenvolden, K. A., **1982**, Marine gas hydrates - I: Geochemical evidence: *in* Cox, J.L., ed., Natural Gas Hydrates: Properties, Occurrence, and Recovery: Butterworth, Boston, p. 63-72.

Kvenvolden, K. A., McDonald, T., et al., **1982**, Gas hydrates in continental margin sediments of the Middle America Trench--Summary of results from DSDP/IPOD Leg 84: Methane Hydrates Workshop, Technical Proceedings, DOE/METC/82-49, p. 82-91.

Dillon, W. P., and Kvenvolden, K. A., **1982**, Gas hydrates in seafloor sediments off southeastern United States: Evidence from seismic reflection and drilling data: Methane Hydrates Workshop, Technical Proceedings, DOE/METC/82-49, p. 78-81.

Kvenvolden, K. A., and Barnard, L. A., **1983**, Hydrates of natural gas in continental margins: *in* Watkins, J.S., and Drake, C.L., eds., Studies in Continental Margin Geology, American Assocociation of Petroleum Geologists, Memoir 34, p. 631-640.

Kvenvolden, K. A., and Barnard, L. A., **1983**, Gas hydrates of the Blake Outer Ridge, Site 533, Deep Sea Drilling Project Leg 76: *in* Sheridan, R. E., Gradstein, F. et al., Initial Reports Deep Sea Drilling Project, v. 76, Washington (U.S. Govt. Printing Office), p. 353-365.

Kvenvolden, K. A., Barnard, L. A., and Cameron, D. H., **1983**, Pressure core barrel: applications to the study of gas hydrates, Deep Sea Drilling Project Site 533, Leg 76: *in* Sheridan, R. E., Gradstein, F. et al., Initial Reports Deep Sea Drilling Project, v. 76, Washington (U.S. Govt. Printing Office), p. 367-375.

Kvenvolden, K.A., **1983**, Gas hydrates on continental margins of the United States based in occurrence of bottom-simulating reflectors on marine seismic records: U.S. Geological Survey, Open-File Report 83-822, 1 sheet.

Kvenvolden, K.A., Claypool, G.E., Threlkeld, C.N., and Sloan, D.E., **1984**, Geochemistry of a naturally occurring massive marine gas hydrate: *in* Schenck, P.A., deLeeuw, J.W., and Lijmbach, G.W.M., eds., Advances in Organic Geochemistry 1983, Organic Geochemistry, v. 6., p. 703-713.

Galimov, E.M., and Kvenvolden, K.A., **1984**, Geochemistry of gases in the gas hydrate-bearing sediments of the Blake Outer Ridge area, Atlantic Ocean: Geokhimiya, v. 7, p. 1075-1082; also, 1985, Geochemistry International, v. 22, p. 106-112.

Kvenvolden, K.A., and McDonald, T.J., **1985**, Gas hydrates of the Middle America Trench-DSDP/IPOD Leg 84: *in* von Huene, R., Aubouin, J., et al., Initial Reports Deep Sea Drilling Project, v. 84: Washington (U.S. Govt. Printing Office), p. 667-682.

Kvenvolden, K.A., **1985**, Comparison of marine gas hydrates in sediments of an active and passive continental margin: Marine and Petroleum Geology, v. 2, p. 65-71.

Brooks, J.M., Jeffrey, A.W.A., McDonald, T.J., Pflaum, R.C., and Kvenvolden, K.A., **1985**, Geochemistry of hydrate gas and water from Site 570, DSDP Leg 84: *in* von Huene, R., Aubouin, J., et al., Initial Reports Deep Sea Drilling Project, v. 84: Washington (U.S. Gov't Printing Office), p. 699-703.

Field, M.E., and Kvenvolden, K.A., **1985**, Gas hydrates on the northern California continental margin: Geology, v. 13, p. 517-520.

Kvenvolden, K.A., **1985**, Gas hydrates at two sites of an active continental margin: Proceedings, 55th Annual California Regional Meeting, Society of Petroleum Engineers, Bakersfield, California, SPE 13592, p. 23-29.

Field, M.E., and Kvenvolden, K.A., **1986**, Reply on "Gas hydrates on the northern California continental margin": Geology, v. 14, p. 536-538.

Kvenvolden, K.A., and Cooper, A.K., **1987**, Natural gas hydrates of the offshore Circum-Pacific margin - a future energy resource?, *in* Horn, M.K., ed., Transactions, 4th Circum-Pacific Energy and Mineral Resources Conference, Circum-Pacific Council for Energy and Mineral Resources, p. 285-297.

Collett, T.S., Kvenvolden, K.A., Magoon, L.B., and Bird, K.J., **1987**, Geochemical and geologic controls on the inferred occurrence of natural gas hydrate in the Kuparuk 2D-15 well, North Slope, Alaska, *in* Hamilton, T.D., and Galloway, J.P., eds., Geologic Studies in Alaska by the U.S. Geological Survey during 1986: U.S. Geological Survey Circular 998, p. 24-26.

Collett, T.S., and Kvenvolden, K.A., **1987**, Evidence of naturally occurring gas hydrates on the North Slope of Alaska: U.S. Geological Survey Open-File Report 87-255, 8 p.

Kvenvolden, K.A., **1987**, Gas hydrates offshore Alaska and western continental United States, *in* Scholl, D.W., Grantz, A., and Vedder, J.G., eds., Geology and Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins--Beaufort Sea to Baja California: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 6, p. 581-593.

Collett, T.S., and Kvenvolden, K.A., **1988**, Natural gas hydrate, *in* Magoon, L.B., Petroleum Systems of the United States: U.S. Geological Survey Bulletin 1870, p. 46-47.

Kvenvolden, K.A., **1988**, Natural gas, *in* Magoon, L.B., Petroleum Systems of the United States: U.S. Geological Survey Bulletin 1870, p. 44-45.

Kvenvolden, K.A., **1988**, Methane hydrate: a major reservoir of organic carbon in the shallow geosphere?: Chemical Geology, v. 71, p. 41-51.

Kvenvolden, K.A., and Claypool, G.E., **1988**, Gas hydrates in oceanic sediment: U.S. Geological Survey Open-File Report 88-216, 50 p.

Collett, T.S., Bird, K.J., Kvenvolden, K.A., and Magoon, L.B., **1988**, Geologic interrelations relative to gas hydrates within the North Slope of Alaska: U.S. Geological Survey Open-File Report 88-389, 150 p.

Collett, T.S., Bird, K.J., Kvenvolden, K.A., and Magoon, L.B., **1989**, The origin of natural gas hydrates on the North Slope of Alaska, *in* Dover, J.H., and Galloway, J.P., eds., Geologic Studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 3-9.

Kvenvolden, K.A., and Grantz, A., **1990**, Gas hydrates of the Arctic Ocean region: *in* Grantz, A., Johnson, L., and Sweeney, J.F., eds., The Arctic Ocean region: Boulder, Colorado, Geological Society of America, The Geology of North America, v. L, p. 539-549.

Collett, T.S., Kvenvolden, K.A., and Magoon, L.B., **1990**, Characterization of hydrocarbon gas within the stratigraphic interval of gas hydrate stability on the North Slope of Alaska, USA: Applied Geochemistry, v. 5, p. 279-287.

Kvenvolden, K.A., and Kastner, M., **1990**, Gas hydrates of the Peruvian outer continental margin: *in* Suess, E., von Huene, R., et al., Proceedings Ocean Drilling Program, Scientific Results, 112: College Station, Texas (Ocean Drilling Program), p. 517-526.

Collett, T.S., and Kvenvolden, K.A., **1990**, Natural gas hydrates: The petroleum system--status of research and methods: U.S. Geological Survey Bulletin 1912, p. 72-73.

Collett, T.S., and Kvenvolden, K.A., **1990**, Exploration for gas hydrates: Geological Journal (Russian), n. 1, p. 8-14.

Max, M.D., Dillon, W.P., Malone, R.D., and Kvenvolden, K.A., **1991**, National workshop on gas hydrates: Transactions, American Geophysical Union, v. 72, p. 476-477.

Kvenvolden, K.A., and Suess, E., **1991**, Gas hydrates and Ocean Drilling: JOIDES Journal, v. 17, n. 3, p. 29-31.

Ginsburg, G.D., Soloviev, V.A., Cranston, R.E., Lorenson, T.D., and Kvenvolden, K.A., **1993**, Gas hydrates from the continental slope offshore from Sakhalin Island, Okhotsk Sea: Geo-Marine Letters, v. 13, p. 41-48.

Kvenvolden, K.A., Ginsburg, G.D., and Soloviev, V.A., **1993**, Worldwide distribution of subaquatic gas hydrates: Geo-Marine Letters, v. 13, p. 32-40.

Kvenvolden, K.A., **1993**, A primer on gas hydrates: *in* Howell, D.G., ed., Future of Energy Gases, USGS Prof. Paper 1570, p. 279-291.

Kvenvolden, K.A., **1993**, Gas hydrates as a potential energy resource--a review of their methane content: *in* Howell, D.G., ed., Future of Energy Gases, USGS Prof. Paper 1570, p. 555-561.

Kvenvolden, K.A., **1994**, Natural gas hydrate occurrence and issues: *in* Sloan, E.D., Happel, J., and Hnatow, M.A., eds., International Conference on Natural Gas Hydrates, Annals of the New York Academy of Sciences, v. 715, p. 232-246.

Froelich, P.N., Kvenvolden, K.A., Torres, M.E., Waseda, A., Didyk, B.M., and Lorenson, T.D., **1995**, Geochemical evidence for gas hydrate in sediment near the Chile Triple Junction: *in* Lewis, S.D., Behrmann, J., Musgrave, R., et al., Proceedings Ocean Drilling Program, Scientific Results, 141: College Station, Texas (Ocean Drilling Program), Director's approval 12/93, 33 p.

Kvenvolden, K.A., **1995**, Geochemistry of methane in natural gas hydrate: *in* Rice, D.D., and Schoell, M., eds., Sources of Natural Gas, American Association of Petroleum Geologists, Director's approval, 4/94.

Geochemistry in Global Change

Collett, T.S., Bird,, K.J., Kvenvolden, K.A., and Magoon, L.B., **1986**, The effect of freezing - point depression on ice-bearing permafrost, North Slope of Alaska: Transactions, American Geophysical Union, v. 67, p. 949.

Kvenvolden, K.A., **1988**, Methane hydrates and global climate: Global Biogeochemical Cycles, v. 2, p. 221-229.

Collett, T.S., Bird, K.J., Kvenvolden, K.A., and Magoon, L.B., **1989**, Map showing the depth to the base of the deepest ice-bearing permafrost as determined from well logs, North Slope, Alaska: Oil and Gas Investigations, Map OM-222.

Kvenvolden, K.A., **1991**, A review of Arctic gas hydrates as a source of methane in global change: *in* Weller, G., Wilson, C.L., and Severin, B.A.B., eds., International Conference on the Role of the Polar Regions in Global Change: Proceedings of a conference held June 11-15, 1990 at the University of Alaska Fairbanks, Geophysical Institute and Center for Global Change and Arctic System Research, University of Alaska Fairbanks, v. II, p. 696-701.

Kvenvolden, K.A., and Lorenson, T.D., **1993**, Methane in permafrost--Preliminary results from coring at Fairbanks, Alaska: Chemosphere, v. 26, p. 609-616.

Kvenvolden, K.A., Lilley, M.D., Lorenson, T.D., Barnes, P.W., and McLaughlin, E., **1993**, The Beaufort Sea continental shelf as a seasonal source of atmospheric methane: Geophysical Research Letters, v.20, p. 2459-2462.

Kvenvolden, K.A., Collett, T.S., and Lorenson, T.D., **1993**, Studies of permafrost and gas hydrates as possible sources of atmospheric methane at high latitudes, *in* Oremland, R.S., ed., Biogeochemistry of Global Change, Chapman & Hall, New York, p. 487-501.

Kvenvolden, K.A., **1993**, Gas hydrates--Geological perspective and global change: Reviews of Geophysics, v. 31, p. 173-187.

Collett, T.C., and Kvenvolden, K.A., **1993**, Significance of natural-gas hydrate at the Mackenzie Delta drill site: The Nansen Icebreaker, Spring 1993, n. 4, p. 1, 6-8.

Collett, T.C., and Kvenvolden, K.A., **1993**, Interrelations between gas hydrates of northern Alaska and atmospheric methane: U.S. Geological Survey Circular 1086, p. 77-78.

Kvenvolden, K.A., and Collett, T.C., **1993**, Permafrost and gas hydrates as possible sources of atmospheric methane at high latitudes: U.S. Geological Survey Circular 1086, p. 92-93.

Kvenvolden, K.A., and Lorenson, T.D., **1994**, Methane in the CRREL permafrost tunnel at Fox, Alaska: U.S. Geological Survey Bulletin, Director's approval, 16 p.

Environmental Geochemistry

Rapp, J. B., Kvenvolden, K. A., and Clifton, H. E., **1982**, Aliphatic hydrocarbons in surface sediments of Willapa Bay and Grays Harbor, Washington: U.S. Geological Survey Open-File Report 82-609, 12 p.

Rapp, J.B., and Kvenvolden, K.A., **1982**, Organic geochemistry of sediments on the flanks of Tanner and Cortes Banks offshore from southern California: U.S. Geological Survey Open-File Report 82-829, ll p.

Kvenvolden, K. A., and Harbaugh, J. W., **1983**, Reassessment of the rate at which oil from natural sources enters the marine environment: Marine Environmental Research, v. 10, p. 223-243.

Kvenvolden, K. A., Rapp, J. R., and Redden, G. D., **1983**, Hydrocarbons in sediments on the flanks of the Tanner and Cortes Banks: *in* Gravett, C. C., McClendon, L. T., and Hertz, H. S., eds., A Summary of Activities Related to Offshore Drilling of Petroleum at the NBS 1975-1981, EPA-600/7-83-004, p. 173-174.

Clifton, H.E., Kvenvolden, K.A., and Rapp, J.B., **1984**, Spilled oil and infaunal activity - modification of burrowing behavior and redistribution of oil: Marine Environmental Research, v. 11, p. 111-136.

Hostettler, F.D., Rapp, J.B., Kvenvolden, K.A., and Luoma, S.N., **1988**, Biogenic and anthropogenic organic markers as source disciminants and sediment transport indicators in south San Francisco Bay, California: U.S. Geological Survey Open-File Report 88-408, 28 p.

Hostettler, F.D., Rapp, J.B., Kvenvolden, K.A., and Luoma, S.N., **1989**, Organic markers as source discriminants and sediment transport indicators in south San Francisco Bay, California: Geochimica et Cosmochimica Acta, v. 53, p. 1563-1576.

Rapp, J.B., Hostettler, F.D., and Kvenvolden, K.A., **1990**, Comparison of *Exxon Valdez* oil with extractable material from deep-water bottom sediment in Prince William Sound and the Gulf of Alaska: *in* Carlson, P.R., and Reimnitz, E. (eds.), Bottom sediment along oil spill trajectory in Prince William Sound and along Kenai Peninsula, Alaska, U.S. Geological Open-File Report 90-39-B, 36 p.

Hostettler, F.D., Rapp, J.B., and Kvenvolden, K.A., **1991**, Geochemical investigation of an oil spill in San Francisco Bay, California: U.S. Geological Survey Open-File Report 91-130, 25 p.

Kvenvolden, K.A., Hostettler, F.D., and Rapp, J.B., **1991**, Short-term effects of oil spills on the molecular record in sediments of San Francisco Bay, California, and Prince William Sound, Alaska: *in* Manning, D.A.C., ed., Organic Geochemistry, Advances and Applications in Energy and the Natural Environment, Manchester University Press, Manchester, U.K., p. 527-530.

Kvenvolden, K.A., Rapp, J.B., and Hostettler, F.D., **1991**, Tracking hydrocarbons from the *Exxon Valdez* oil spill in beach, shallow-water, and deep-water sediment of Prince William Sound, Alaska, *in* Carlson, P.R., ed., Sediment of Prince William Sound, beach to deep-fjord floor, a year after the *Exxon Valdez* spill: U.S. Geological Survey Open-File Report 91-631, p. 69-98.

Hostettler, F.D., Rapp, J.B., and Kvenvolden, K.A., **1992**, Use of geochemical biomarkers in bottom sediment to track oil from a spill, San Francisco Bay, California: Marine Pollution Bulletin, v. 24, p. 15-20.

Pereira, W.E., Hostettler, F.D., and Rapp, J.B., **1992**, Bioaccumulation of hydrocarbons derived from terrestrial and anthropogenic sources in the Asian clam, *Potamocorbula amurensis*, in San Francisco Bay estuary: Marine Pollution Bulletin, v. 24, p. 103-109.

Kvenvolden, K.A., Hostettler, F.D., Rapp, J.B., and Carlson, P.R., **1993**, Hydrocarbons in oil residues on beaches of islands of Prince William Sound, Alaska: Marine Pollution Bulletin, v. 26, p. 24-29.

Kvenvolden, K.A., Carlson, P.R., Threlkeld, C.N., and Warden, A., **1993**, Possible connection between two Alaskan catastrophes occurring 25 yr apart (1964 and 1989): Geology, v. 21, p. 813-816.

Hostettler, F.D., and Kvenvolden, K.A., **1994**, Geochemical transformations of crude oil spilled from the *Exxon Valdez* supertanker into Prince William Sound, Alaska: Organic Geochemistry, Director's approval, 1/93, 22 p.

Hostettler, F.D., Rapp, J.B., Pereira, W.E., and Kvenvolden, K.A., **1994**, A survey of molecular marker compounds in sediments of San Francisco Bay, California, *in* Morganwalp, D.W., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program: U.S. Geological Survey Water-Resources Investigations Report 94-4014, 16 p.

Carlson, P.R., and Kvenvolden, K.A., **1995**, Tracking *Exxon Valdez* oil from beach to deep-water sediments of Prince William Sound, Alaska: Proceedings, *Exxon Valdez* Oil Spill Symposium, Anchorage, Alaska, Feb. 1-5, 1993, Director's approval, 29 p.

Petroleum Geochemistry

Field, M. E., Kvenvolden, K. A., and Clarke, S. E., Jr., **1979**, Location and hydrocarbon content of a gravity core from the offshore Eel River Basin, Northern California: U.S. Geological Survey Open-File Report 79-1618, 1 p.

Kvenvolden, K. A., and Claypool, G. E., **1980**, Origin of gasoline-range hydrocarbons and their migration by solution in carbon dioxide in Norton Basin, Alaska: American Association of Petroleum Geologists Bulletin, v. 64, p. 1078-1086.

Kvenvolden, K. A., **1980**, Organics yield clues about oil in the deep sea: Geotimes, v. 25, no. 7, p. 19-20.

Kvenvolden, K. A., and Field, M. E., **1981**, Thermogenic hydrocarbons in unconsolidated sediment of Eel River Basin, offshore northern California: American Association of Petroleum Geologists Bulletin, v. 65, p. 1642-1646.

Rapp, J.B., **1984**, Computer program for geochemical correlation studies: U.S. Geological Survey Open-File Report 84-415, 26 p.

Eittreim, S.L., Cooper, A.K., and Scientific Staff (including Kvenvolden, K.A.), **1984**, Marine Geological and Geophysical Investigations of the Antarctic Continental Margin, 1984: U.S. Geological Survey Circular 935, 12 p.

Kvenvolden, K.A., Rapp, J.B., and Bourell, J.H., **1985**, Comparison of molecular markers in crude oils and rocks form the North Slope of Alaska: *in* Magoon, L.B. and Claypool, G.E., eds., Alaska North Slope Oil/Rock Correlation Study, American Association of Petroleum Geologists, Studies in Geology No. 20, p. 593-617.

Kvenvolden, K.A., Rapp, J.B., Hostettler, F., Morton, J.L., King, J.D., and Claypool, G.E., **1986**, Petroleum hydrocarbons associated with polymetallic sulfides in sediment from Gorda Ridge: Science, v. 234, p. 1231-1234.

Kvenvolden, K.A., Rapp, J.B., Golan-Bac, M., and Hostettler, F.D., **1987**, Multiple sources of alkanes in Quaternary oceanic sediment of Antarctica: Organic Geochemistry, v. 11, p. 291-302.

Koski, R.A., Zierenberg, R.A., Kvenvolden, K.A., and Shanks, W.C., III, **1987**, Mineralogy and chemistry of hydrothermal sulfide and petroleum deposits from the Escanaba Trough, Gorda Ridge: U.S. Geological Survey Circular 995, 35 p.

Kvenvolden, K.A., Rapp, J.B., and Hostettler, F.D., **1987**, Hydrocarbon geochemistry of petroleum associated with sediment-hosted sulfides from Escanaba Trough, southern Gorda Ridge: U.S. Geological Survey Open-File Report 87-375C, 18 p.

Kvenvolden, K.A., Rapp, J.B., Hostettler, F.D., King, J.D., and Claypool, G.E., **1988**, Organic geothermometry of petroleum from Escanaba Trough, offshore northern California: Advances in Organic Geochemistry 1987, Organic Geochemistry, v. 13, p. 351-355.

Snavely, P.D., Jr., and Kvenvolden, K.A., **1988**, Preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane, west side of the Olympic Peninsula, Washington: Part 1, Geology and hydrocarbon potential: U.S. Geological Survey Open-File Report 88-75, p. 1-26.

Kvenvolden, K.A., Rapp, J.B., Hostettler, F.D., and Snavely, P.D., Jr., **1988**, Preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane, west side of the Olympic Peninsula, Washington: Part 2, Comparison of molecular markers in oil and rock extracts: U.S. Geological Survey Open-File Report 88-75, p. 27-49.

Snavely, P.D., Jr., and Kvenvolden, K.A., **1989**, Preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane, west side of the Olympic Peninsula, Washington: A. Geology and hydrocarbon potential: U.S. Geological Survey Bulletin 1892, p. 1-17.

Kvenvolden, K.A., Rapp. J.B., Hostettler, F.D., and Snavely, P.D., Jr., **1989**, Preliminary evaluation of the petroleum potential of the Tertiary accretionary terrane, west side of the Olympic Peninsula, Washington: B. Comparison of molecular markers in oil and rock extracts: U.S. Geological Survey Bulletin 1892, p. 21-35.

Kvenvolden, K.A., and Simoneit, B.R.T., **1990**, Hydrothermally derived petroleum: Examples from Guaymas Basin, Gulf of California, and Escanaba Trough, northeast Pacific Ocean: American Association of Petroleum Geologists Bulletin, v. 74, p. 223-237.

Kvenvolden, K.A., Rapp. J.B., and Hostettler, F.D., **1990**, Hydrocarbon geochemistry of hydrothermally generated petroleum from Escanaba Trough, offshore California, USA: Applied Geochemistry, v. 5, p. 83-91.

Kvenvolden, K.A., Hostettler, F.D., and Frank, T.J., **1990**, Hydrocarbons in sediment of the Weddell Sea, Antarctica: *in* Barker, P.F., Kennett, J.P., et al., Proceedings Ocean Drilling Program, Scientific Results, 113: College Station, Texas (Ocean Drilling Program), p. 199-208.

Kvenvolden, K.A., Hostettler, F.D., Rapp, J.B., and Snavely, P.D., Jr., **1991**, Biomarkers in Tertiary melange, western Olympic Peninsula, Washington, U.S.A.: Chemical Geology, v. 93, p. 101-110.

Kvenvolden, K.A., Hostettler, F.D., Rapp, J.B., and Frank, T.J., **1991**, Aliphatic hydrocarbons in sediments from Prydz Bay, Antarctica: *in* Barron, J., Larsen, et al., Proceedings Ocean Drilling Program, Scientific Results, 119: College Station, Texas (Ocean Drilling Program), p. 417-423.

Leif, R.N., Simoneit, B.R.T., and Kvenvolden, K.A., **1991**, Simulation of hydrothermal petroleum generation by laboratory hydrous pyrolysis: *in* Manning, D.A.C., ed., Organic Geochemistry, Advances and Applications in Energy and the Natural Environment, Manchester University Press, Manchester, U.K., p. 300-303.

Rapp, J.B., **1991**, A statistical approach to the interpretation of aliphatic hydrocarbon distributions in marine sediments: Chemical Geology, v. 93, p. 163-177.

Leif, R.N., Simoneit, B.R.T., and Kvenvolden, K.A., **1992**, Hydrous pyrolysis of n-$C_{32}H_{66}$ in the presence and absence of inorganic components: American Chemical Society, Division of Fuel Chemistry, Preprints, v. 37, n. 4, p. 1748-1753.

Simoneit, B.R.T., and Kvenvolden, K.A., **1994**, Comparison of ^{14}C ages of hydrothermal petroleum: Organic Geochemistry, v. 21, p. 525-529.

Kvenvolden, K.A., Hostettler, F.D., Rapp, J.B., Littke, R., Disko, U., Scholz-Böttcher, B., and Rullkötter, J., **1995**, High-molecular-weight hydrocarbons in a south lattitude setting offshore from Chile (Site 859, Leg 141): *in* Lewis, S.D., Behrmann, J., Musgrave, R., et al., Proceedings Ocean Drilling Program, Scientific Results, 141: College Station, Texas (Ocean Drilling Program), Director's approval 12/93, 24 p.

Rapp, J.B., and Hostettler, F.D., **1994**, Hydrocarbons in sediments of the North Pacific: in Hein, J.R., and Bychkov, A.S., editors, Data and results from R.V. Aleksandr Vinogradov Cruise 91-AV-19/1--91-AV-19/4, Northwest Pacific and Bering Sea sediment geochemistry and paleo-oceanographic studies, U.S. Geological Survey Open-File Report 94-230.

Kvenvolden, K.A., Rapp, J.B., and Hostettler, F.D., **1994**, Hydrocarbons in sediment from Escanaba Trough, *in* Morton, J.L., Zierenberg, R.A., and Reiss, C.A., eds., Geologic, Hydrothermal, and Biologic Studies at Escanaba Trough, Gorda Ridge, Offshore Northern California: U.S. Geological Survey Bulletin 2022, Director's approval 11/93, 23 p.

Kvenvolden, K.A., Rapp, J.B., Hostettler, F.D., and Rosenbauer, R.J., **1994**, Laboratory thermal alteration of hydrocarbons in sediment from Escanaba Trough, Offshore northern California: Organic Geochemistry, Director's approval,11/93, 24 p.

Geochemistry of Deep Ocean Drilling

Kvenvolden, K. A., **1976**, Organic Geochemistry, Leg 38: Introduction to Studies. *In* Talwani, M., Udintsex, G. et al., 1976. Initial Reports of the Deep Sea Drilling Project, 38: Washington (U.S. Govt. Printing Office), p. 783-784.

Kvenvolden, K. A., **1977**, Organic Geochemistry, Leg 41--Introduction and Summary: *in* Lancelot, Y., Seibold, E. et al., 1977, Reports of the Deep Sea Drilling Project, v. 41: Washington (U.S. Govt. Printing Office), p. 815.

Kvenvolden, K. A., **1978**, Introduction to Organic Geochemistry Studies, DSDP Leg 44: *in* Benson, W. E., Sheridan, R. E. et al., 1978, Initial Reports of the Deep Sea Drilling Project, v. 44, Washington (U.S. Govt. Printing Office), p. 585.

Kvenvolden, K. A., **1980**, Organic Geochemistry, Deep Sea Drilling Project Sites 415 and 416: Introduction and Summary: *in* Lancelot, Y., Winterer, E. L. et al., Initial Reports of the Deep Sea Drilling Project, v. 50, Washington (U.S. Govt. Printing Office), p. 553-554.

Kvenvolden, K. A., **1981**, Organic geochemistry in the Deep Sea Drilling Project: *in*: Warme, J. E., Douglas, R. G., and Winterer, E. C., eds., The Deep Sea Drilling Project: A Decade of Progress: Society of Economic Paleontologists and Mineralogists, Special Publication 32, p. 227-249.

Aubouin, J., von Huene, R., Baltuck, M., Arnott, R., Bourgois, J., Filewicz, M., Kelm, R., Kvenvolden, K., Lienert, B., McDonald, T., McDougall, K., Ogawa, Y., Taylor, E., and Winsborough, B., **1982**, Subduction sans accretion: La marge pacifique du Guatemala: premiers resultats du Leg 84 du Deep Sea Drilling Project (janvier-fevier 1982): C. R. Acad. Sc. Paris, t. 294, Serie II, p. 803-812.

Aubouin, J., von Huene, R., Baltuck, M., Arnott, R., Bourgois, J., Filewicz, M., Kvenvolden, K., Leinert, B., McDonald, T., McDougall, K., Ogawa, Y., Taylor, E., and Winsborough, B., **1982**, Leg 84 of the Deep Sea Drilling Project - subduction without accretion: Middle America Trench off Guatemala: Nature, v. 297, p. 458-460.

Sheridan, R. E., Gradstein, F. M., Barnard, L. A., Bliefnick, D. M., Habib, D., Jenden, P. D., Kagami, H., Keenan, E. M., Kostecki, J., Kvenvolden, K. A., Moullade, M., Ogg, J., Robertson, A. H. F., Roth, P. H., Shipley, T. H., Wells, L., Bowdler, J.L., Cotillon, P. H., Halley, R. B., Kinoshita, H., Patton, J.W., Pisciotto, K. A., Premoli-Silva, I., Testarmata, M. M., Tyson, R. V., and Watkins, D. K., **1982**, Early history of the Atlantic Ocean and gas hydrates on the Blake Outer Ridge: Results of the Deep Sea Drilling Project Leg 76: Geological Society of America Bulletin, v. 93, p. 876-885.

Kvenvolden, K. A., **1984**, Organic Geochemistry: *In*: Heath, G. R., ed., Sedimentology, Physical Properties, and Geochemistry in the Initial Reports of the Deep Sea Drilling Project Volumes 1-44: An Overview: World Data Center A for Marine Geology and Geophysics, Report MGG-1, p. 201-213.

Kvenvolden, K.A., and McDonald, T.J., **1986**, Organic geochemistry on the *JOIDES Resolution*--an assay: Ocean Drilling Program, Technical Note 6, 147 p.

Emeis, K-C., and Kvenvolden, K.A., **1986**, Shipboard organic geochemistry on *JOIDES Resolution*: Ocean Drilling Program, Technical Note 7, 130 p.

Eldholm, O. Thiede, J., et al. including Kvenvolden, K.A., **1986**, Formation of the Norwegian Sea: Nature, v. 319, p. 360-361.

von Huene R., Suess, E., and Leg 112 Shipboard Scientists (including Kvenvolden, K.A.), **1988**, Ocean Drilling Program Leg 112, Peru continental margin: Part 1, Tectonic history: Geology, v. 16, p. 934-938.

Suess, E., von Huene, R., and Leg 112 Shipboard Scientists (including Kvenvolden, K.A.), **1988**, Ocean Drilling Program Leg 112, Peru continental margin: Part 2, Sedimentary history and diagenesis in a coastal upwelling environment: Geology, v. 16, p. 939-943.

Suess, E., von Huene, R., and Leg 112 Shipboard Scientists (including Kvenvolden, K.A.), **1988**, Proceedings of the Ocean Drilling Program, Peru continental margin; covering Leg 112 of the cruises of the drilling vessel *JOIDES Resolution*, 20 October 1986-25 December 1986. Proceedings of the Ocean Drilling Program, Part A: Initial Report 112, August 1988, 1015 p. (K.A. Kvenvolden contributed to the following chapters: Introduction, objectives, and principal results, p. 5-23; Explanatory notes, p. 25-44; Underway geophysics, p. 45-70; Site 679, p. 159-248; Site 680, p. 249-303; Site 681, p. 305-362; Site 682, p. 363-435; Site 683, p. 437-523; Site 684, p. 525-595; Site 685, p. 597-704; Site 686, p. 705-802; Site 687, p. 803-871; Site 688, p. 873-1004.)

Kastner, M., Elderfield, H., Martin, J.B., Suess, E., Kvenvolden, K.A., and Garrison, R.E., **1989**, Diagenesis and interstitial water chemistry at the Peruvian continental margin--major constituents and strontium isotopes, *in* Suess, E., von Huene, R., et al., Proceedings of the Ocean Drilling Program, Scientific Results,112: College Station, Texas (Ocean Drilling Program), p. 413-440.

Kvenvolden, K.A., and McDonald, T.J., **1989**, Organic geochemistry on Leg 104: *in* Eldholm, O., Thiede, J., Taylor, E., et al., Proceedings Ocean Drilling Program, Scientific Results,104: College Station, TX (Ocean Drilling Program), p. 291-307.

Amino-Acid Geochronology (Aminostratigraphy)

Wehmiller, J. F., Lajoie, K. R., Kvenvolden, K. A., Peterson, E., Belknap, D. F., Kennedy, G. L., Addicott, W. O., Vedder, J. G., and Wright, R. W., **1977**, Correlation and chronology of Pacific Coast marine terrace deposits of continental United States by fossil amino acid stereochemistry: Technique evaluation, relative ages, kinetic model ages, and geologic implications: U.S. Geological Survey Open-File Report 77-680.

Pollock, G. E., and Kvenvolden, K. A., **1978**, Stereochemistry of amino acids in surface samples of a marine sediment: Geochimica et Cosmochimica Acta, v. 42, p. 1903-1905.

Kvenvolden, K. A., Blunt, D. J., and Clifton, H. E., **1979**, Amino-acid racemization in Quaternary shell deposits at Willapa Bay, Washington: Geochimica et Cosmochimica Acta, v. 43, p. 1505-1520.

Kvenvolden, K. A., and Blunt, D. J., **1979**, Amino acid dating of bone nuclei in manganese nodules from the North Pacific Ocean: *in* Bischoff, J. L., and Piper, D. Z., eds., Marine Geology and Oceanography of the Pacific Manganese Nodule Province, Plenum, New York, p. 763-773.

Bada, J. L., Hoopes, E., Darling, D., Dungworth, G., Kessels, H. J., Kvenvolden, K. A., and Blunt, D. J., **1979**, Amino acid racemization dating of fossil bones -- I: Interlaboratory comparison of racemization measurements: Earth and Planetary Science Letters, v. 43, p. 265-268.

Kvenvolden, K. A., and Blunt, D. J., **1980**, Amino acid dating of *Saxidomu giganteus* at Willapa Bay, Washington, by racemization of glutamic acid: *in* Hare, P. E., Hoering, T. C., and King, K., Jr., eds., Biogeochemistry of Amino Acids, Wiley, New York, p. 393-399.

Kvenvolden, K. A., **1980**, Interlaboratory comparison of amino acid racemization in a Pleistocene mollusk, *Saxidomu giganteus*: *in* Hare, P. E., Hoering, T. C., and King, K., Jr., eds., Biogeochemistry of Amino Acids, Wiley, New York, p. 223-232.

Kvenvolden, K. A., Blunt, D. J., McMenamin, M. A., and Strahan, S.E., **1980**, Geochemistry of amino acids in shells of the clam *Saxidomus*: *in* Douglas, A. G., and Maxwell, J. R., eds., Advances in Organic Geochemistry 1979, Pergamon Press, Oxford, p. 321-332.

Kvenvolden, K. A., Blunt, D. J., and Clifton, H. E., **1981**, Age estimations based on amino acid racemization: reply to comments of J. F. Wehmiller: Geochimica et Cosmochimica Acta, v. 45, p. 265-267.

Blunt, D. J., Kvenvolden, K. A., and Sims, J. D., **1981**, Geochemistry of amino acids from Clear Lake, California: Geology, v. 9, p. p. 378-382.

Blunt, D.J., Kvenvolden, K.A., **1981**, A preliminary report on amino acid diagenesis in fossil molluscs recovered from the Navarin Basin Province, Bering Sea, *in* Carlson, P.A., and Karl, H.E., eds., Seafloor geologic hazards, sedimentology, and bathymetry, Navarin Basin Province, Northwest Bering Sea: U.S. Geological Survey Open-File Report 81-1217, p.138-149.

Bada, J.L., Ho, M-S., Kvenvolden, K.A., and Blunt, D.J., **1981**, Amino acid racemization analyses of fossil bones from the caune de L'Arago at Tautavel: *in* deLunley, H., and Labeyrie, J., Datations Absolues et analyses Isotopiques en Prehistoire Methodes et Limites, Colloque International du Centre National de la Recherche Scientifique, p. 585-599.

Kvenvolden, K. A., and Blunt, D. J., **1982**, Amino acids in sediments from Leg 68 Site 502: *in*: Prell, W. L., Gardner, J. V., et al., Initial Reports of the Deep Sea Drilling Project, v. 68, Washington (U.S. Govt. Printing Office), p. 475-480.

Blunt, D. J., Kvenvolden, K. A., and Sims, J. D., **1982**, Geochemistry of amino acids in sediments from Clear Lake, California--Reply: Geology, v. 10, p. 124-125.

McMenamin, M. A. S., Blunt, D. J., Kvenvolden, K. A., Miller, S. E., Marcus, L. F., and Pardi, R. R., **1982**, Amino acid geochemistry of fossil bones from Rancho La Brea asphalt deposit, California: Quaternary Research, v. 18, p. 174-183.

Bada, J. L., Cronin, J. R., Ho, M-S., Kvenvolden, K. A., Lawless, J.G., Miller, S. L., Oro, J., and Steinberg, S., **1983**, On the reported optical activity of amino acids in the Murchison meteorite: Nature, v. 301, p. 494-496.

Blunt, D.J., and Kvenvolden, K.A., **1983**, Aspartic acid geochronology of molluscs, *in* Karl, H.A., and Carlson, P.R., eds., Surface and Near-surface Geology, Navarin Basin Province: Results of the 1980-81 Field Season, U.S. Geological Survey Open-File Report 84-89, Chapter 11, p. 113-118.

Blunt, D.J., and Kvenvolden, K.A., **1988**, Amino acid diagenesis and its implications for late Pleistocene lacustrine sediment, Clear Lake, California, *in* Sims, J.D., ed., Geological Studies of the Clear Lake Basin, Lake County, California: Geological Society of America, Special Paper 214, p. 161-170.

Book Reviews and Reports

Kvenvolden, K. A., **1980**, Book Review of Tissot, B., and Welte, D., Petroleum Formation and Occurrence, Springer-Verlag, Berlin 1978: Organic Geochemistry, v. 2, p. 115-116.

Kvenvolden, K. A., **1980**, Organic geochemistry: Journal of Sedimentary Petrology, v. 50, p. 306-310.

Kvenvolden, K. A., **1980**, Geochemistry of Organic Molecules: Dowden, Hutchinson & Ross, Inc., Stroudsburg, Penn., 357 p.

Kvenvolden, K. A., **1980**, Book Review of Hunt, J. M., Petroleum Geochemistry and Geology, W. H. Freeman, San Francisco: American Assocociation of Petroleum Geologists Bulletin, v. 64, p. 954-956.

Kvenvolden, K. A., **1980**, Book Review of Petrakis, L., and Weiss, F.T., eds., Petroleum in the Marine Environment, American Chemical Society: Science, v. 210, p. 1241.

Kvenvolden, K. A., **1981**, Marine sediments - organic sediments: Yearbook of Science and Technology 1982-1983, McGraw-Hill, New York, p. 294-297.

Kvenvolden, K.A., **1989**, Book Review of Hovland, M., and Judd, A.G., Seabed Pockmarks and Seepage--Impact on Geology, Biology and the Marine Environment: Science, v. 244, p. 590-591.

Bada, J.L., and Kvenvolden, K.A., **1990**, Racemization dating, discussions: Science, v. 248, p. 539-540.

Kvenvolden, K.A., **1993**, Organic Geochemistry: Macmillan Encyclopedia of Earth Sciences, Macmillan Publishing Company, New York, Director's approval, 2/93, 7 p.

Kvenvolden, K.A., **1993**, Book Review, Bacterial Gas, edited by R. Vially: Marine Geophysical Researches, v. 15, p. 241.

Kvenvolden, K.A., **1994**, Book Review, Organic Matter: Productivity, Acccumulation, and Preservation in Recent and Ancient Sediments: Marine and Petroleum Geology, v. 11, p. 248-249.

Kvenvolden, K.A., **1994**, Book Review: Organic Geochemistry--Principles and Applications: Organic Geochemistry, v. 22, p. 353-354.

BIBLIOGRAPHY OF USGS MARINE ORGANIC GEOCHEMISTRY
Abstracts

Natural Gas Geochemistry

Kvenvolden, K. A., and Redden, G. D., **1977**, Low molecular weight hydrocarbons in sediments of the southern Bering shelf: Geological Society of America, Abstracts with Programs, v. 9, p. 449.

Kvenvolden, K. A., Redden, G. D., and Carlson, P. R., **1977**, Hydrocarbon gases in sediments of eastern Gulf of Alaska: American Association of Petroleum Geologist Bulletin, v. 61, p. 806.

Kvenvolden, K. A., and Redden, G. D., **1977**, Hydrocarbon gases in southern Bering Shelf sediments: Geological Society of America, Abstracts with Programs, v. 9, p. 1063.

Kvenvolden, K. A., Rapp, J. B., and Nelson, C. H., 1978, Low molecular weight hydrocarbons in sediments from Norton Sound: American Assocociation of Petroleum Geologists Bulletin, v. 62, p. 534.

Molnia, B. F., Carlson, P. R., and Kvenvolden, K. A., **1978**, Gas-charged sediment areas in the northern Gulf of Alaska: Geological Society of America, Abstracts with Programs, v. 10, p. 458-459.

Kvenvolden, K. A., and Redden, G. D., **1978**, Reconnaissance studies of hydrocarbon gases in sediments from the shelf, slope and abyssal plain beneath the Bering Sea: 34th Annual Southwest Regional Meeting, American Chemical Society, Corpus Christi, Texas, November 29 - December 1, 1978, p. 55.

Kvenvolden, K. A., Redden, G. D., and Nelson, C. H., **1979**, Gases in near-surface sediment of the northern Bering Sea: International Assoc. Sedimentologists, International Meeting on Holocene Marine Sedimentation in the North Sea Basin, Abstract Volume, p. 82.

Kvenvolden, K. A., Field, M. E., and Clarke, S. H., **1980**, Thermogenic hydrocarbon gases in unconsolidated seafloor deposits, Northern California continental margin: American Association of Petroleum Geologists Bulletin, v. 64, p. 736.

Kvenvolden, K. A., **1980**, Geochemical/geophysical prospecting for hydrocarbons in marine sediments, offshore Alaska, USA: Abstracts, 26th International Geological Congress, v. 2, p. 781.

Redden, G. D., Weliky, K., Kvenvolden, K. A., and Hampton, M. A., **1980**, Geochemistry of low molecular weight hydrocarbons in sediment of the western Gulf of Alaska: Geological Society of America, Abstracts with Programs, v.12, p. 148.

Vogel, T. M., Kvenvolden, K. A., and Oremland, R. S., **1980**, Hydrocarbon gases in surface sediments of San Francisco Bay, California: Abstracts, 61st Annual Meeting, Pacific Division, American Association for the Advancement of Science, p. 33.

Vogel, T. M., Kvenvolden, K. A., Carlson, P. R., and Karl, H. A., **1981**, Geochemical prospecting for hydrocarbons in Navarin Basin province: American Association of Petroleum Geologists Bulletin, v. 65, p. 1004.

Kvenvolden, K.A., Golan-Bac, M., and Rapp, J.B., **1984**, Hydrocarbon gases in sediments of the South Pacific Ocean: Transactions, American Geophysical Union, v. 65, p. 949.

Lorenson, T.D., Kvenvolden, K.A., Simoneit, B.R.T., and Leif, R.N., **1991**, Varying sources of gases from thermal springs of northwestern Wyoming: 1991 Abstracts with Programs, Geological Society of America, v. 23, n. 5, p. A153.

Lorenson, T.D., Kvenvolden, K.A., and Oremland, R.S., **1991**, Methane and other hydrocarbon gases in the floats of the giant kelp *Macrocystis Pyrifera*: Abstracts, 10th International Symposium on Environmental Biogeochemistry, San Francisco, August 1991, p. 23-24.

Lorenson, T.D., and Kvenvolden, K.A., **1993**, A comparison of hydrocarbon gases from springs and seeps of varied geologic provinces of the northwestern U.S.: Abstracts with Program 1993, Geological Society of America, v. 25, n. 5, p. 111.

Kvenvolden, K.A., Lorenson, T.D., and Niem, A.R., **1994**, Natural gas occurrences in the Coast Range of southern Oregon: Abstracts with Programs, Geological Society of America, v. 26, n. 7, p. A-36.

Geochemistry of Gas Hydrates--Occurrence and Resource

Kvenvolden, K. A., **1981**, Geochemistry of natural gas hydrates in oceanic sediments: Program and Abstracts, 10th International Meeting on Organic Geochemistry, Bergen, Norway, September 1981, p. 43-44.

Kvenvolden, K. A., Barnard, L. A., and Cameron, D. H., **1981**, Recovery by pressure core barrel of natural gas hydrate from the Blake Outer Ridge: Transactions, American Geophysical Union, v. 62, p. 303.

Kvenvolden, K. A., and Dillon, W. P., **1981**, Natural-gas hydrates of the Blake Ridge Region, Atlantic Continental Margin: American Association of Petroleum Geologists Bulletin, v. 65, p. 1665.

Kvenvolden, K. A., and Claypool, G. E., **1981**, Origin of natural gas hydrates in oceanic sediment: Transactions, American Geophysical Union, v. 62, p. 900.

Kvenvolden, K. A., et al., **1982**, Gas hydrates of the Middle America Trench, Deep Sea Drilling Project Leg 84: Transactions, American Geophysical Union, v. 63, p. 1015.

Kvenvolden, K. A., Claypool, G. E., and Sloan, E. D., **1983**, Geochemistry of a naturally occurring massive marine gas hydrate: Programs and Abstracts, 11th International Meeting on Organic Geochemistry, p. 43.

Kvenvolden, K.A., **1984**, Geochemical conditions in sediment containing gas hydrates of active and passive continental margins: American Association of Petroleum Geologists Bulletin, v. 69, p. 276-277.

Collett, T.S., Bird, K.J., Magoon, L.B., Kvenvolden, K.A., and Claypool, G.E., **1986**, Gas hydrates, North slope of Alaska, *in* Carter L.M.H., ed., USGS Research on Energy Resources - 1986, Program and Abstracts, U.S. Geological Survey Circular 974, p. 11-12.

Kvenvolden, K.A., and Cooper, A.K., **1986**, Natural gas hydrates of the Circum-Pacific margin - a future energy resource?: American Association of Petroleum Geologists Bulletin, v. 70, p. 928.

Kvenvolden, K.A., **1987**, Methane hydrate: A major reservoir of carbon in the shallow geosphere: Abstracts with Programs, 1987, Geological Society of America, v. 19, p. 736.

Collett, T.S., Kvenvolden, K.A., and Magoon, L.B., **1987**, Geochemistry and origin of natural gas from an inferred occurrence of gas hydrate, North Slope of Alaska: Abstracts, 13th International Meeting on Organic Geochemistry, Venice, Italy, p. 232.

Claypool, G.E., Kvenvolden, K.A., and Whiticar, M.J., **1987**, Geochemical factors affecting the occurrence of marine gas hydrates: Abstracts, 13th International Meeting on Organic Geochemistry, Venice, Italy, p. 8.

Kvenvolden, K.A., and Kastner, M., **1988**, Gas hydrates in sediment of the Peruvian Continental Margin: American Chemical Society, Division of Geochemistry, Third Chemical Congress of North America, Abstract No. 1.

Collett, T.S., Bird, K.J., Kvenvolden, K.A., and Magoon, L.B., **1989**, Gas hydrates of Arctic Alaska: American Association of Petroleum Geologists Bulletin, v. 73, p. 345-346

Kvenvolden, K.A., **1989**, Methane and methane hydrate offshore at the Circum-Pacific margin: Abstracts, 28th International Geological Congress, Washington, D.C., v. 2, p. 247-248.

Magoon, L.B., Collett, T.S., and Kvenvolden, K.A., **1989**, Natural gas hydrate--a key to petroleum remigration on the Alaskan North Slope: Abstracts, 14th International Meeting on Organic Geochemistry, Paris, France, No. 31.

Kvenvolden, K.A., and Claypool, G.E., **1989**, The case for biogenic methane as the principal component of naturally occurring gas hydrates: Abstracts and Program, Bacterial Gas Conference, Milan, Italy, September 25-26, p. 39

Grantz, A., Hart, P.E., and Kvenvolden, K.A., **1989**, Seismic reflection character, distribution, estimated volume and stability of gas hydrate deposits beneath the Arctic Ocean north of Alaska: Transactions, American Geophysical Union, v. 70, p. 1152.

Kvenvolden, K.A., **1990**, Gas hydrates of outer continental margins: American Association of Petroleum Geologists Bulletin, v. 74, p. 698.

Kvenvolden, K.A., and Collett, T.S., **1990**, The global methane hydrate reservoir--Impact on petroleum exploration: *in* Carter, L.M.H. (ed.), U.S.G.S. Research on energy resources--1990: Program and Abstracts, 6th V.E. McKelvey Forum on Mineral and Energy Resources, U.S. Geological Survey Circular 1060, p. 44-46.

Collett, T.S., and Kvenvolden, K.A., **1992**, Isotopic characterization of the methane within the gas hydrate-bearing rock units of northern Alaska, U.S.A.: Abstracts, International Symposium, Unconventional Hydrocarbon Sources, Problems of Exploration and Production, St. Petersburg, Russia, Oct. 12-16, 1992, All-Russia Petroleum Scientific-Research Geological-Exploration Institute, v. II, p. 57-58.

Ginsburg, G.D., Soloviev, V.A., Cranston, R.E., Lorenson, T.D., and Kvenvolden, K.A., **1992**, Gas hydrate recovery from the continental slope near Sakhalin Island, Okhotsk Sea: Transactions, American Geophysical Union, v.73, n. 14, Supplement, p. 167.

Soloviev, V.A., Kvenvolden, K.A., and Ginsburg, G.D., **1992**, The review of submarine gas hydrates world data: Abstracts, International Symposium, Unconventional Hydrocarbon Sources, Problems of Exploration and Production, St. Petersburg, Russia, Oct. 12-16, 1992, All-Russia Petroleum Scientific-Research Geological-Exploration Institute, v. II, p. 71-72.

Kvenvolden, K.A., **1993**, Subaquatic gas hydrate occurrence--Models and settings: Transactions, American Geophysical Union,v. 74, n. 43, Supplement, p. 369.

Froelich, P.N., Kvenvolden, K.A., Torres, M., and Shipboard Scientific Party, **1993**, Evidence for gas hydrate in the accretionary prism near the Chile Triple Junction: Transactions, American Geophysical Union, v. 74, n. 43, Supplement, p. 369.

Geochemistry in Global Change

Kvenvolden, K.A., **1987**, Worldwide occurrence of marine gas hydrates: Implications for future atmospheric methane concentrations: 193rd National Meeting, American Chemical Society, Denver, Colorado, April 5-10, 1987, Division of Geochemistry, Abstract No. 27.

Kvenvolden, K.A., **1989**, Gas hydrate--a sink and source for methane in the global carbon cycle and its effect on global change: 9th International Symposium on Environmental Biogeochemistry, Moscow, USSR, September 4-8, 1989, p. 4.

Kvenvolden, K.A., and Collett, T.S., **1989**, Arctic gas hydrates and global climate: Transactions, American Geophysical Union, v. 70, p. 1151.

Collett, T.S., and Kvenvolden, K.A., **1989**, Distribution and origin of permafrost-associated gas hydrates in northern Alaska: Transactions, American Geophysical Union, v. 70, p. 1151.

Kvenvolden, K.A., **1990**, Estimate of current methane release from gas hydrates: 1990 Abstracts with Programs, Geological Society of America, v. 22, n. 7, p. A195.

Kvenvolden, K.A., **1990**, Arctic gas hydrates as a source of methane in global change: Abstracts, International Conference on the Role of the Polar Regions in Global Change, University of Alaska, Fairbanks, Alaska, June 11-15, 1990, p. 211.

Kvenvolden, K.A., Collett, T.S., and Williams, R.S., **1991**, Methane in permafrost ice near Fairbanks, Alaska: Transactions, American Geophysical Union, v. 72, n. 17, Supplement, p. 67.

Kvenvolden, K.A., and Lorenson, T.D., **1991**, Varying amounts of methane in shallow permafrost cores from Alaska: Transactions, American Geophysical Union, v. 72, n. 44, Supplement, p. 162.

Kvenvolden, K.A., and Kayen, R.E., **1991**, Gas hydrates as a geologic hazard in submarine environments: 1991 Abstracts with Programs, Geological Society of America, v. 23, n. 2, p. 43.

Kvenvolden, K.A., and Collett, T.S.,**1991**, Permafrost and gas hydrates as sources of methane at high latitudes: Abstracts, 10th International Symposium on Environmental Biogeochemistry, San Francisco, August 1991, p. 22.

Kvenvolden, K.A., Lorenson, TD., and Collett, T.C., **1991**, Arctic shelf gas hydrate as a possible source of ethane: 1991 Abstracts with Programs, Geological Society of America, v. 23, n. 5, p. A238.

Kvenvolden, K.A., Lorenson, T.D., and Reeburgh, W.S., **1992**, Methane in permafrost--Preliminary studies at the CRREL permafrost tunnel near Fox, Alaska: Transactions, American Geophysical Union, v. 73, n. 14, Supplement, p. 119.

Kvenvolden, K.A., Lorenson, T.D., and Lilley, M.D., **1992**, Methane in the Beaufort Sea on the continental shelf of Alaska: Transactions, American Geophysical Union, v. 73, n. 43, Supplement, p. 309.

Lorenson, T.D., Kvenvolden, K.A., and Lilly, M.R., **1992**, Methane in permafrost--comparison of frozen and thawed ground: Transactions, American Geophysical Union, v. 73, n. 43, Supplement, p. 182-183.

Kvenvolden, K.A., Lorenson, T.D., Barnes, P.W., Lilley, M.D., and Olson, E.J., **1993**, Methane in ice-covered, continental shelf waters of the Beaufort Sea, Alaska: Transactions, American Geophysical Union, v. 74, n. 43, Supplement, p. 121.

Lorenson, K.A., Kvenvolden, T.D., Barnes, P.W., Lilley, M.D., and Olson, E.J., **1993**, Methane in coastal sea ice, Beaufort Sea, Alaska: Transactions, American Geophysical Union, v. 74, n. 43, Supplement, p. 121.

Kvenvolden, K.A., **1993**, Gas hydrates (clathrates) in the geosciences--Resource, hazard, and global change: American Association of Petroleum Geologists Bulletin, v. 77, p. 2020.

Lorenson, T.D., Kvenvolden, K.A., and Lilley, M.D., **1994**, A comparison of methane concentrations in ice-covered and ice-free shelfal waters of the Beaufort Sea, Alaska: Transactions, American Geophysical Union, v. 75, n. 3, Supplement, p. 93.

Kvenvolden, K.A., Lorenson, T.D., Barnes, P.W., Popp, B.N., Sansone, F.J., Rust, T.M., Lilley, M.D., and Olsen, E.J., **1994**, Possible sources of methane in seasonal ice of the Alaskan Beaufort Sea: Transactions, American Geophysical Union, v. 75, n. 44, Supplement, p. 77.

Environmental Geochemistry

Rapp, J. B., Kvenvolden, K. A., and Clifton, H. E., **1976**, Hydrocarbons in sediments of Willapa Bay, Washington: Transactions, American Geophysical Union, v. 57, p. 931.

Clifton, H. E., Kvenvolden, K. A., and Rapp, J. B., **1979**, Spilled oil and infaunal activity - Modification of burrowing behavior and redistribution of the oil: American Association of Petroleum Geologists Bulletin, v. 63, p. 433-434.

Rapp, J. B., Kvenvolden, K. A., and Clifton, H. E., **1979**, Hydrocarbons in sediments of Willapa Bay and Grays Harbor, Washington: Geological Society of America, Abstracts with Programs, v. 11, p. 123.

Hostettler, F.D., Rapp, J.B., Kvenvolden, K.A., and Luoma, S.N., **1987**, Hydrocarbons and n-aldehydes in south San Francisco Bay sediment: Transactions, American Geophysical Union, v. 68, p. 1336.

Hostettler, F.D., Rapp, J.B., Kvenvolden, K.A., and Luoma, S.N., **1989**, Biomarkers as sediment transport indicators in an estuarine system: 197th National Meeting, American Chemical Society, Division of Geochemistry, Abstract 71.

Hostettler, F.D., Kvenvolden, K.A., and Rapp, J.B., **1991**, Tracking spilled oil in San Francisco Bay sediment: 1991 Abstracts with Programs, Geological Society of America, v. 23, n. 2, p. 36.

Carlson, P.R., and Kvenvolden, K.A., **1992**, Sediment of Prince William Sound, the aftermath of the Exxon Valdez oil spill: Program and Proceedings, 43rd Arctic Science Conference, American Association for the Advancement of Science, Geophysical Institute, University of Alaska Fairbanks, p. 128.

Kvenvolden, K.A., and Carlson, P.R., **1992**, Non-Exxon Valdez-related tar on shores of Prince William Sound, Alaska: Program and Proceedings, 43rd Arctic Science Conference, American Association for the Advancement of Science, Geophysical Institute, University of Alaska Fairbanks, p. 130.

Carlson, P.R., and Kvenvolden, K.A., **1993**, Tracking *EXXON VALDEZ* oil from beach to deep-water sediments of Prince William Sound, Alaska: *EXXON VALDEZ* Oil Spill Symposium, Abstract Book, General Services Administration, Region Nine, Juneau, Alaska, p. 43-45.

Hostettler, F.D., Rapp, J.B., Pereira, W.E., and Kvenvolden, K.A., **1993**, A survey of molecular marker compounds in sediments of San Francisco Bay, California: U.S. Geological Survey Toxic Substances Hydrology Program--Abstracts of the Technical Meeting, Colorado Springs, Colorado, September 20-24, 1993, U.S. Geological Survey Open-File Report 93-454, p. 113.

Hostettler, F.D., Pereira, W.E., Rapp, J.B., and Kvenvolden, K.A., **1993,** Organic molecular marker compounds in sediments of San Francisco Bay, California: Abstracts with Programs, Geological Society of America, v. 25, n. 6, p. A-288.

Hostettler, F.D., Pereira, W.E., Rapp, J.B., and Kvenvolden, K.A., **1994**, Records of contaminant input to San Francisco Bay: 8. Biomarker profiles in sediment cores: Transactions, American Geophysical Union, v. 75, n. 3, Supplement, p. 234.

Kvenvolden, K.A., Carlson, P.R., Threlkeld, C.N., and Warden, A., **1994**, Carbon isotopic identification of two sources of oil residues in Prince William Sound, Alaska: American Chemical Society, Division of Environmental Chemistry, Preprints of Papers Presented at the 207th ACS National Meeting, v. 34, n. 1, p. 575.

Petroleum Geochemistry

Field, M. E., Clarke, S. H., Jr., and Kvenvolden, K. A., **1980**, Diapir-like ridges and possible hydrocarbon occurrence, northern California continental margin: American Association of Petroleum Geologists Bulletin, v. 64, p. 706.

Mullins, H. T., Nagel, D. K., Kvenvolden, K. A., and Rapp, J. B., **1981**, Evidence for shallow hydrocarbon accumulation offshore northern Santa Cruz County, California: Geological Society of America, Abstracts with Programs, v. 13, p. 98.

Mullins, H. T., Nagel, D. K., Kvenvolden, K. A., and Rapp, J. B., **1981**, Evidence for shallow hydrocarbon accumulation offshore northern Santa Cruz County, California: Geological Society of America, Abstracts with Programs, v. 13, p. 98.

Kvenvolden, K. A., Rapp, J. B., and Bourell, J. H., **1983**, North Slope, Alaska, oil-rock correlation study: preliminary analyses of possible source rocks: *in* Magoon, L.B. and Claypool, G.E., eds., Alaska North Slope Oil-Rock Correlation Study--A Compilation of Abstracts: American Association of Petroleum Geologists, Catalogue No. 480, p. 26.

Kvenvolden, K. A., Rapp, J. B., and Bourell, J. H., **1983**, North Slope, Alaska, oil-rock correlation study: preliminary analyses of possible source rocks: *in* Magoon, L.B. and Claypool, G.E., eds., Alaska North Slope Oil-Rock Correlation Study--A Compilation of Abstracts: American Association of Petroleum Geologists, Catalogue No. 480, p. 26.

Kvenvolden, K.A., and Snavely, P.D., Jr., **1985**, Hydrocarbon gas potential of accretionary melange terranes: An example from the Olympic Peninsula, Washington: Geological Society of America, Abstracts with Programs 1985, v. 17, p. 636.

Kvenvolden, K.A., Morton, J.L., and Holmes, M.L., **1986**, Hydrothermal petroleum associated with polymetallic sulfides, Escanaba Trough, offshore northern California: Geological Society of America, Abstracts with Programs, v. 18, p. 663.

Koski, R.A., and Kvenvolden, K.A., **1986**, Polymetallic sulfide associated with asphaltic petroleum at the Gorda Ridge spreading center, offshore northern California: Transactions, American Geophysical Union, v. 67, p. 1283.

Kvenvolden, K.A., Rapp, J.B., Hostettler, F.D., Claypool, G.E., and King, J.D., 1987, Geochemistry of hydrothermally-derived petroleum from Escanaba Trough, offshore northern California: Abstracts, 13th International Meeting on Organic Geochemistry, Venice, Italy, p. 233.

Kvenvolden, K.A., and Simoneit, B.R.T., **1987**, Petroleum from northeast Pacific Ocean hydrothermal systems in Escanaba Trough and Guaymas Basin: American Association of Petroleum Geologists Bulletin, v. 71, p. 580.

Kvenvolden, K.A., Rapp, J.B., and Hostettler, F.D., **1988**, Hydrothermally-generated petroleum from Escanaba Trough, offshore California: American Chemical Society, Division of Geochemistry, Third Chemical Congress of North America, Abstract No. 47.

Zierenberg, R.A., Shanks, W.C., Koski, R.A., Morton, J.L., Normark, W.R., Kvenvolden, K.A., and Holmes, M.L., **1988**, Massive sulfide deposition and sediment alteration in the Escanaba Trough, Gorda Ridge, Northeast Pacific Ocean: Abstracts, 28th International Geological Congress, Washington, D.C., v. 3, p. 448.

Rapp, J.B., **1989**, A statistical approach to the interpretation of aliphatic hydrocarbon distributions in marine sediments: The 1989 International Congress of Pacific Basin Societies, Honolulu, Hawaii, Abstract INOR 16.

Kvenvolden, K.A., Rapp, J.B., Hostettler, F.D., and Simoneit, B.R.T., **1989**, Escanaba Trough: A natural laboratory for the study of petroleum genesis: Proceedings, 14th International Meeting on Organic Geochemistry, Paris, France, No. 217.

Kvenvolden, K.A., Hostettler, F.D., Rapp, J.B., and Snavely, P.D., Jr., **1989**, Biomarkers in Tertiary melange, Western Olympic Peninsula, Washington: The 1989 International Chemical Congress of Pacific Basin Societies, Honolulu, Hawaii, December 17-22, 1989, Abstract INOR 0201.

Koski, R.A., Morton, J.L., Zierenberg, R.A., Shanks, W.C. III, Campbell, A.C., and Kvenvolden, K.A., **1991**, The geologic setting and composition of large sulfide mounds, hydrothermal fluids, and altered sediment in Escanaba Trough, southern Gorda Ridge: Elements of a mature hydrothermal system at a sediment-covered spreading axis: *in* Good, E.E., Slack, J.F., and Kotra, R.K. (eds.), USGS Research on mineral resources--1991: Program and Abstracts, 7th V.E. McKelvey Forum on Mineral and Energy Resources, U.S. Geological Survey Circular 1062, p. 46-47.

Wong, F.L., Richmond, B.A., Greene, H.G., Dingler, J.R., Hein, J.R., Kvenvolden, K.A., Marlow, M.S., Morton, J.L., Rubin, D.M., Scholl, D.W., and Vedder, J.G., **1991**, SOPAC--A decade of research on mineral and hydrocarbon resources in the South Pacific: *in* Good, E.E., Slack, J.F., and Kotra, R.K. (eds.), USGS Research on mineral resources--1991: Program and Abstracts, 7th V.E. McKelvey Forum on Mineral and Energy Resources, U.S. Geological Survey Circular 1062, p. 78-79.

Leif, R.N., Simoneit, B.R.T., and Kvenvolden, K.A., **1992**, Hydrous pyrolysis of n-$C_{32}H_{66}$ in the presence and absence of inorganic components: 204th National Meeting, American Chemical Society, Division of Geochemistry, Abstract 121.

Geochemistry of Deep Ocean Drilling

Kvenvolden, K. A., **1979**, Organic geochemistry of sediments recovered by DSDP/IPOD: Am. Assoc. Petroleum Geologists Bulletin, v, 63, p. 483.

Aubouin, J., von Huene, R., Baltuck, M., Arnott, R., Bourgois, J., Filewicz, M., Kvenvolden, K., Lienert, B., McDonald, T., McDougall, K., Ogawa, Y., Taylor, E., and Winsborough, B., **1982**, Subduction without accretions along the Middle America Trench off Guatemala (DSDP Leg 84): Geological Society of America, Abstracts with Programs, v. 14, p. 436.

Phillips, J.D., Winkler, H., Stoffa, P., and Leg 104 Shipboard Staff including Kvenvolden, K.A., **1985**, Vertical seismic profile in seaward dipping reflector sequence - Vøring Plateau, ODP Leg 104, Site 642: Transactions, American Geophysical Union, v. 66, p. 977.

Kastner, M., Suess, E., Garrison, R.E., and Kvenvolden, K.A., **1987**, Hydrology, geochemistry, and diagenesis along the convergent margin of Peru: Transactions, American Geophysical Union, v. 68, p. 1499.

Kastner, M., Martin, J., Suess, E., Garrison, R.E., Kvenvolden, K., and von Huene, R., **1988**, Evidence for density and tectonically driven fluid migration in convergent margin sediments off Peru: Transactions, American Geophysical Union, v. 69, p. 1263.

Amino-Acid Geochronology (Aminostratigraphy)

Kvenvolden, K. A.,Blunt, D. J., and Clifton, H. E.,**1977**, Application of amino acid stereochemistry to the correlation of late Pleistocene deposits at Willapa Bay, Washington: Geological Society of America, Abstracts with Programs, v. 9, p. 1062-1063.

Blunt, D. J., and Kvenvolden, K. A., **1979**, Accretion rates of manganese nodules determined by racemization of amino acids in bone nuclei: Geological Society of America, Abstracts with Programs, v. 11, p. 70.

Kvenvolden, K. A., Blunt, D. J., Robinson, S. W., and Bacon, G., **1979**, Amino-acid dating of an archaeological site on Amaknak Island, Alaska: Geological Society of America, Abstracts with Programs, v. 11, p. 462.

Kvenvolden, K.A., **1979**, Applications to geochronology of the stereochemistry of amino acids in the mollusk Saxidomus giganteus: Abstracts, 9th International Meeting on Organic Geochemistry, Newcastle Upon Tyne, England, Sept. 17-20, p. 22-23.

Blunt, D. J., Kvenvolden, K. A.,and Warnke, D., **1982**, Comparison of amino acid geochemistry in fossil mollusks and wood, Pacific Northwest, United States: Geological Society of America, Abstsracts with Programs, v. 14, p. 445.

Blunt, D. J., and Kvenvolden, K. A., **1983**, Amino-acid diagenesis in late Pleistocene sediments of Core CL-80-1, Clear Lake, California: Geological Society of America, Abstracts with Programs, v. 15, p 278.