

**ESCOLA UNIVERSITÀRIA POLITÈCNICA DE MANRESA**

*Departament d'Enginyeria Minera i Recursos Naturals*

**ESTUDI DELS MARCADORS  
BIOMARCADORS DE CONQUES  
ALTAMENT REDUCTORES**

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- JUZLOVÁ, P., REZANKA, T., MARTINKOVA, M. i KREN, V. (1996) Long chain fatty acids from *Monascus purpureus*. *Phytochem.* **43**, 151-153.
- KAJIWARA, T., HATANAKA, A., MATSUI, K., TOMOI, T., FUJIMURA, T. i KAWAI, T. (1992) Distribution of long chain aldehyde-forming activity from fatty acids and changes in its activity with growth in marine algae. *Phytochem.* **31**, 2635-2639.
- KANEDA, T. (1967) Fatty acids in the genus *Bacillus*. I. Iso- and anteiso-fatty acids as characteristic constituents of lipids in 10 species. *J. Bacteriol.* **93**, 894-903.
- KARLINER, J. i DJERASSI, C. (1966) Terpenoids. LVII. Mass spectral and nuclear magnetic resonance studies of pentacyclic triterpene hydrocarbons. *J. Am. Chem.* **31**, 1945-1955.
- KARLSON, B., POTTER, D. KUYLENSTIERNA, M. i ANDERSON, R.A. (1996) Ultrastructure, pigment composition and 18S rRNA gene sequence for *Nannochloropsis granulata* sp. nov. (Monodopsidaceae, Eustigmatophyceae), a marine ultraplankton isolated from the Skagerrak, North East Atlantic Ocean. *Phycol.* **35**, 253-260.
- KASPRZYK, Z. i PYREK, J. (1968) Triterpenic alcohols of *Calendula officinalis* L. Flowers. *Phytochem.* **7**, 1631-1639.
- KATZ, B.J. (1995) Petroleum Source Rocks-an Introductory Overview. A *Petroleum Source Rocks*. Springer-Verlag, pp. 1-8. Heidelberg, Alemanya.
- KAWAMURA, K. i GAGOSIAN, R. B. (1987) Implications of  $\omega$ -oxocarboxylic acids in the remote marine atmosphere for photo-oxidation of unsaturated fatty acids. *Nature* **325**, 330-332.
- KAWAMURA, K. i GAGOSIAN, R. B. (1988a) Identification of aliphatic keto carboxylic acids in marine aerosols using capillary gas chromatography-mass spectrometry. *J. Chromatogr.* **438**, 299-307.
- KAWAMURA, K. i GAGOSIAN, R. B. (1988b) Identification of isomeric hydroxy fatty acids in aerosol samples by capillary gas chromatography-mass spectrometry. *J. Chromatogr.* **438**, 309-317.
- KAWAMURA, K. i ISHIWATARI, R. (1984a) Fatty acid geochemistry of a 200 m sediment core sample from Lake Biwa, Japan. Early diagenesis and paleoenvironmental information. *Geochim. Cosmochim. Acta* **48**, 251-266.
- KAWAMURA, K. i ISHIWATARI, R. (1984b) Tightly bound aliphatic acids in Lake Biwa sediments. Their origin and stability. *Org. Geochem.* **7**, 121-126.

- KAWAMURA, K., ISHIWATARI, R. i OGURA, K. (1987) Early diagenesis of organic matter in the water column and sediments: microbial degradation and resynthesis of lipids in Lake Haruna. *Org. Geochem.* **4**, 251-264.
- KAWAMURA, K., KASUKABE, H. i BARRIE L.A. (1996) Source and reaction pathways of dicarboxylic acids, ketoacids and dicarbonyls in Arctic aerosols: one year of observations. *Atmos. Environ.* **30**, 1709-1722.
- KAWKA, O.E. i SIMONEIT, B.R.T. (1994) Hydrothermal pyrolysis of organic matter in Guaymas Basin: I. Comparison of hydrocarbon distributions in subsurface sediments and seabed petroleum. *Org. Geochem.* **22**, 947-978.
- KEELY, B.J., BLAKE, S.R., SCHAEFFER, P. i MAXWELL, J.R. (1995) Distributions of pigments in the organic matter of marls from the Vena del Gesso evaporitic sequence. *Org. Geochem.* **23**, 527-539.
- KENIG, F., HUC, A.Y., PURSER, B.H. i OUDIN, J.L. (1990) Sedimentation, distribution and diagenesis of organic matter in a recent carbonate environment, Abu Dhabi, U.A.E.. *Org. Geochem.* **16**, 485-526.
- KENIG, F., HUC, A., SINNINGHE DAMSTÉ, J.S. i DE LEEUW, J.W. (1995a) Occurrence and origin of mono- di- and trimethylalkanes in modern and Holocene microbial mats from Abu Dhabi, United Arab Emirates. *Geochim. Cosmochim. Acta* **59**, 2999-3015.
- KENIG, F., SINNINGHE DAMSTÉ, J.S., FREWIN, N.L., HAYES, J.M. i DE LEEUW, J.W. (1995b) Molecular indicators for palaeoenvironmental change in a Messinian evaporitic sequence (Vena del Gesso, Italy). II: High-resolution variations in abundances and  $^{13}\text{C}$  contents of free and sulphur-bound carbon skeletons in a single marl bed. *Org. Geochem.* **23**, 485-526.
- KESTER, A.S. i FOSTER, J.W. (1963) Diterminal oxidation of long chain alkanes by bacteria. *J. Bacteriol.* **85**, 859-869.
- KETTLER, R.M. (1995) Incipient bitumen generation in Miocene siliceous sedimentary rocks from the Japan Sea. *Org. Geochem.* **23**, 699-708.
- KILLINGER, A. (1970) Der abbau von undecan durch ein marines bakterium. *Arch. Mikrobiol.* **73**, 160-176.
- KILLOPS, S.D. i FREWIN, N.L. (1994) Triterpenoid diagenesis and cuticular preservation. *Org. Geochem.* **21**, 1193-1209.
- KILLOPS, S.D., HOWELL, V.J., MASSOUD, M.S. i SCOTT, A.C. (1991) Role of bacteria in oil generation from higher plant material: biomarker evidence from oils from Korea Bay Basin. A *Organic Geochemistry: Advances and Applications in Energy and the Natural Environment*. 15th International Meeting of the European Association of Organic Geochemistry, Manchester, England, September, 1991. Poster



Abstracts, eds David Manning, pp. 53-55. A.I.G.O.A., Manchester University Press, Manchester. Anglaterra.

- KIMBLE, B.J., MAXWELL, J.R., PHILP, R.P., EGLINTON, G., ALBRECHT, P., ENSMINGER, A., ARPINO, P. i OURISSON, G. (1974) Tri- and tetraterpenoid hydrocarbons in the Messel oil shale. *Geochim. Cosmochim. Acta* **38**, 1165-1181.
- KLEEMANN, G., PORALLA, K., ENGLERT, G., KJOSEN, H., LIAAEN-JANSEN, N., NEUNLIST, S. i ROHMER, M. (1990) Tetrahymanol from the phototrophic bacterium *Rhodospirillum rubrum*: First report of gammacerane from a prokaryote. *J. Gen. Microbiol.* **136**, 2551-2553.
- KLINK, G., DREIER, F., BUCHS, A. i GÜLAÇAR, F. O. (1992) A new source for 4-methyl sterols in freshwater sediments: *Utricularia neglecta* L. (Lentibulariaceae). *Org. Geochem.* **18**, 757-763.
- KLOMP, U.C. (1986) The chemical nature of pronounced series of iso-alkanes in South Oman crudes. *Org. Geochem.* **10**, 807-814.
- KODINA, L.A., HUANG, Y., GAVRILOV, Y.O., JONES, M. i EGLINTON, G. (1995) Environment of Upper Paleocene black shale deposition in Southern Russia and adjacent regions as revealed by isotope and biomarker study. A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 192-194. A.I.G.O.A., Donostia-San Sebastián, Espanya.
- KOHNEN, M.E.L., PEAKMAN, T.M., SINNINGHE DAMSTÉ, J.S. i DE LEEUW, J.W. (1990a) Identification and occurrence of novel C<sub>36</sub>-C<sub>54</sub> 3,4-dialkylthiophenes with an unusual carbon skeleton in immature sediments. *Org. Geochem.* **16**, 1103-1113.
- KOHNEN, M.E.L., SCHOUTEN, S., SINNINGHE DAMSTÉ, J.S., DE LEEUW, J.W., MERRIT, D. i HAYES, J.M. (1992) Improved recognition of paleobiochemicals by a combined molecular sulfur and isotope geochemical approach. *Science* **256**, 358-362.
- KOHNEN, M.E.L., SINNINGHE DAMSTÉ, J.S., TEN HAVEN, H.L. i DE LEEUW, J.W. (1989) Early incorporation of polysulphides in sedimentary organic matter. *Nature* **341**, 640-641.
- KOHNEN, M.E.L., SINNINGHE DAMSTÉ, J.S., KOCK-VAN DALEN, A.C., TEN HAVEN, H.L., RULLKÖTTER, J. i DE LEEUW, J.W. (1990b) Origin and diagenetic transformations of C<sub>25</sub> and C<sub>30</sub> highly branched isoprenoid sulphur compounds: Further evidence for the formation of organically bound sulphur during early diagenesis. *Geochim. Cosmochim. Acta* **54**, 3053-3063.
- KOHNEN, M.E.L., SINNINGHE DAMSTÉ, J.S., KOCK-VAN DALEN, A.C. i DE LEEUW, J.W. (1991a) Di- or polysulphide bound biomarkers in sulphur rich



- geomacromolecules as revealed by selective chemolysis. *Geochim. Cosmochim. Acta* **55**, 1375-1394.
- KOHNEN, M.E.L., SINNINGHE DAMSTÉ, J.S. i DE LEEUW, J.W. (1991b) Biases from natural sulfurization in paleoenvironmental reconstruction based on hydrocarbon biomarker distributions. *Nature* **349**, 775-778.
- KOHNEN, M.E.L., SINNINGHE DAMSTÉ, J.S., BAAS, M., KOCK-VAN DALEN, A.C. i DE LEEUW, J.W. (1993) Sulphur-bound steroid and phytane carbon skeletons in geomacromolecules: Implications for the mechanism of incorporation of sulphur into organic matter. *Geochim. Cosmochim. Acta* **57**, 2515-2528.
- KOK, M.D., SCHOUTEN, S. i SINNINGHE DAMSTÉ, J.S. (1995) Laboratory simulation of natural sulphurization: The reactivity of some functionalized model compounds and the catalytic influence of sediment. A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 1047-1049. A.I.G.O.A., Donostia-San Sebastián, Espanya.
- KOKPOL, U., CHAVASIRI, W., CHITTAWONG, V., BRUCE, M., CUNNINGHAM, G.N. i MILES, D.H. (1993) Long chain aliphatic alcohols and saturated carboxylic acids from heartwood of *Rhizophora apiculata*. *Phytochem.* **33**, 1129-1131.
- KOLATTUKUDY, P.E. (1969) Composition on the surface lipids of pea leaves. *Lipids* **5**, 398-402.
- KOLATTUKUDY, P.E. (1976) Chemistry and biochemistry of natural waxes. Elsevier, Amsterdam.
- KOLATTUKUDY, P.E. (1980) Biopolyester membranes of plants: cutin and suberin. *Science* **208**, 990-1000.
- KOLATTUKUDY, P.E. i AGRAWAL, V.P. (1974) Structure and composition of aliphatic constituents of potato suber skin (suberin). *Lipids* **9**, 682-691.
- KOOPMANS, M.P., KÖSTER, J., VAN KAAM-PETERS, H.M.E., KENIG, F., SCHOUTEN, S., HARTGERS, W.A., DE LEEUW, J.W. i SINNINGHE DAMSTÉ, J.S. (1996) Diagenetic and catagenetic products of isorenieratene: Molecular indicators for photic zone anoxia. *Geochim. Cosmochim. Acta* **60**, 4467-4496.
- KOOPMANS, M.P., LEWAN, M.D., SINNINGHE DAMSTÉ, J.S. i DE LEEUW, J.W. (1993) Maturity-related changes in abundance and composition of organic sulphur compounds and sulphur-containing geomacromolecules studied by hydrous pyrolysis. A *Organic Geochemistry. Poster Sessions from the 16th International Meeting on Organic Geochemistry*, Stavanger, Noruega, 22-24 September, 1993 (Editat per Øygard K.), pp. 125-128. Falch Hurtigtrykk, Oslo.

KÖSTER, J., ROSPONDEK, M., ZUBRZYCKI, A., KOTARBA, M., DE LEEUW, J.W. i SINNINGHE DAMSTÉ, J. S. (1995a) A molecular organic geochemical study of black shales associated with diatomites from the Oligocene Menilite Shales (Flysch Carpathians, SE Poland). A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 87-89. A.I.G.O.A., Donostia-San Sebastián, Espanya.

KÖSTER, J., ROSPONDEK, M., KOTARBA, M., ZUBRZYCKI, A., DE LEEUW, J.W. i SINNINGHE DAMSTÉ, J.S. (1997a) Biomarker geochemistry of foredeep basin: the Oligocene Menilite Formation in SE Poland. A *Organic Geochemistry*. 18th International Meeting on Organic Geochemistry, Maastricht, The Netherlands, 22-26 September, 1997. Abstracts Part I, pp. 395-396. Forschungszentrum Jülich, Alemanya.

KÖSTER, J., ROSPONDEK, M., KOTARBA, M., ZUBRZYCKI, A., DE LEEUW, J.W. i SINNINGHE DAMSTÉ, J.S. (1998) Biomarker geochemistry of foreland basin: the Oligocene Menilite Formation in the Flysch Carpathians of Southeast Poland. A *Advances in Organic Geochemistry 1997. Part I. Org. Geochem.* **29**, 649-669.

KÖSTER, J., SCHOUTEN, S., DE LEEUW, J.W. i SINNINGHE DAMSTÉ, J.S. (1993) Palaeoenvironmental and maturity related variations in compositions of macromolecular organic matter and distribution of sulphur and non-sulphur biomarkers in Triassic organic-rich carbonate rocks. A *Organic Geochemistry. Poster Sessions from the 16th International Meeting on Organic Geochemistry*, Stavanger, Noruega, 22-24 September, 1993 (Editat per Øygard K.), pp. 402-406. Falch Hurtigtrykk, Oslo.

KÖSTER, J., SCHOUTEN, S., SINNINGHE DAMSTÉ, J.S. i DE LEEUW, J.W. (1995b) Reconstruction of depositional environment of Toarcian marlstones (Allgäu Formation, Tyrol/Austria) using biomarkers and compound specific carbon isotope analyses. A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 76-78. A.I.G.O.A., Donostia-San Sebastián, Espanya.

KÖSTER, J., VAN KAAM-PETERS, H.M.E., KOOPMANS, M.P., DE LEEUW, J.W. i SINNINGHE DAMSTÉ, J.S. (1997b) Sulphurisation of homohopanooids: Effects on carbon number distribution, speciation, and 22S/22R epimer ratios. *Geochim. Cosmochim. Acta* **61**, 2431-2452.

KÖSTER, J., WEHNER, H. i HUFNAGEL, H. (1988) Organic geochemistry and organic petrology of organic rich sediments withing the "Hauptdolomit" formation (Triassic, Norian) of the Northern Calcareus Alps. *Org. Geochem.* **13**, 377-386.

KURAKOLOVA, E.A., VOROBYOVA, N.S. i BURKOVA, V.N. (1991) Highly branched hydrocarbons in recent sediments. A *Organic Geochemistry: Advances and Applications in Energy and the Natural Environment*. 15th International Meeting of



- the European Association of Organic Geochemistry, Manchester, England, September, 1991. Poster Abstracts, eds David Manning, pp. 525-526. A.I.G.O.A., Manchester University Press, Manchester. Anglaterra.
- KUSUNOSE, E., KUSUNOSE, M. i COON, M. (1964) Enzymatic  $\omega$ -oxidation of fatty acids. *J. Biol. Chem.* **239**, 1374-1380.
- LAFLAMME, R.I. i HITES, R.A. (1978) The global distribution of polycyclic aromatic hydrocarbons in recent sediments. *Geochim. Cosmochim. Acta* **42**, 289-303.
- LAMBERTON, J.A. (1961) The dibasic acids of Japan wax. *Aust. J. Chem.* **14**, 323-324.
- LAMBERTON, J.A. i REDCLIFFE, A.H. (1960) The chemistry of sugar cane wax. *Aust. J. Chem.* **13**, 261-268.
- LARGEAU, C. i DE LEEUW, J.W. (1995) Insoluble, nonhydrolyzable, aliphatic macromolecular constituents of microbial cells-walls. *Adv. Microb. Ecol.* **14**, 77-117.
- LEENDERS, A., BOSCH, H.J., SINNINGHE DAMSTÉ, J.S. i DE LEEUW, J.W. (1997) An Euxinic Pliocene Eastern Mediterranean During Formation of Sapropels. A *Organic Geochemistry*. 18th International Meeting on Organic Geochemistry, Maastricht, The Netherlands, 22-26 September, 1997. Abstracts Part II, pp. 685-686. Forschungszentrum Jülich, Alemanya.
- LEHTONEN, K. i KETOLA, M. (1990) Occurrence of long-chain acyclic methyl ketones in *Sphagnum* and *Carex* peats of various degrees of humification. *Org. Geochem.* **15**, 275-280.
- LEHTONEN, K. i KETOLA, M. (1993) Solvent-extractable lipids of *Sphagnum*, *Carex*, *Bryales* and *Carex-Bryales* peats: content and compositional features vs peat humification. *Org. Geochem.* **20**, 363-380.
- LEIF, R.N. i SIMONEIT, B.R.T. (1995) Ketones in hydrothermal petroleum and sediment extracts from Guaymas Basin, Gulf of California. *Org. Geochem.* **23**, 889-904.
- LEO, R.E. i PARKER, P.L. (1966) Branched-chain fatty acids in sediments. *Science* **152**, 649-650.
- LEYTHAEUSER, D. i SCHWARZCHOPF, TH. (1986) The pristane/n-heptadecane ratio as an indicator for recognition of hydrocarbon migration effects. *Adv. Org. Geochemistry 1985. Org. Geochem.* **10**, 191-197.
- LI, G.L., ZENG, J.F. i ZHU, D.Y. (1998) Chromans from *Evodia lepta*. *Phytochem.* **47**, 101-104.



- LI, M., JOHNS, R.B. i MEI, B. (1990) A study in early diagenesis: biomarker composition of a suite of immature coals and coaly shales. *Org. Geochem.* **16**, 1067-1075.
- LI, M., LARTER, S.R., TAYLOR, P., JONES, D.M., BOWLER, B. i BJORØY, M. (1995) Biomarker or not biomarker? A new hypothesis for the origin of pristane involving derivation from methyltrimethyltridecylchromans (MTTCs) formed during diagenesis from chlorophyll and alkylphenols. *Org. Geochem.* **23**, 159-167.
- LI, M., LIN, R., LIAO, Y., SNOWDON, LL.R., WANG, P. i LI, P. (1999) Organic geochemistry of oils and condensates in the Kekeya Field, Southwest Depression of the Tarim Basin (China). *Org. Geochem.* **30**, 15-37.
- LICHTFOUSE, E., DERENNE, S., MARIOTTI, A. i LARGEAU, C. (1994) Possible algal origin of long-chain odd *n*-alkanes in immature sediments as revealed by distributions and carbon isotope ratios. *Org. Geochem.* **22**, 1023-1027.
- LIN, D.S., ILIAS, A.M., CONNER, W.E., CALDWELL, R.S., COREY, H.T. i DAVIES, G.D., JR. (1982) Composition and biosynthesis of sterols in selected marine phytoplankton. *Lipids* **17**, 818-824.
- LIVSEY, A., DOUGLAS, A.G. i CONNAN, J. (1984) Diterpenoids hydrocarbons in sediments from offshore (Labrador) well. *Org. Geochem.* **6**, 73-81.
- LOGAN, G.A. i EGLINTON, G. (1994) Biogeochemistry of the Miocene lacustrine deposit, at Clarkia, northern Idaho, U.S.A. *Org. Geochem.* **21**, 857-870.
- LOGAN, G.A., SMILEY, C.J. i EGLINTON, G. (1995) Preservation of fossil leaf waxes in association with their source tissues, Clarkia, northern Idaho, USA. *Geochim. Cosmochim. Acta* **59**, 751-763.
- LOTFY, S., JAVELLE, F. i NEGREL, J. (1995) Distribution of hydroxycinnamoyl-CoA:  $\omega$ -hydroxypalmitic acid O-hydroxycinnamoyltransferase in higher plants. *Phytochem.* **40**, 389-391.
- LOUREIRO, M.R.B. i CARDOSO, J.N. (1990) Aromatic hydrocarbons in the Paraíba Valley oil shale. *Org. Geochem.* **15**, 351-359.
- LYTLE, T.F., LYTLE, J.S. i CARUSO, A. (1976) Hydrocarbons and fatty acids of ferns. *Phytochem.* **15**, 965-970.
- MACKENZIE, A.S., BRASSELL, S.C., EGLINTON, G. i MAXWELL, J.R. (1982) Chemical fossil: the geological fate of steroids. *Science* **217**, 491-504.
- MACKENZIE, A.S., HOFFMANN, C.F. i MAXWELL, J.R. (1981) Molecular parameters of maturation in the Toarcian shales, Paris Basin, France-III. Changes in aromatic steroid hydrocarbons. *Geochim. Cosmochim. Acta* **45**, 1345-1355.

- MACKENZIE, A.S., PATIENCE, R.L., MAXWELL, J.R., VANDERBROUKE, M. i DURAND, B. (1980) Molecular parameters of maturation in the Toarcian shales, Paris Basin-I. Changes in the configurations of acyclic isoprenoid alkanes, steranes and triterpanes. *Geochim. Cosmochim. Acta* **44**, 1709-1721.
- MADRIGAL, R.V., PLATTNER, R.D. i SMITH, JR., C.R. (1975) *Carduus nigrescens* Seed Oil-A Rich Source of Pentacyclic Triterpenoids. *Lipids* **10**, 208-213.
- MADUREIRA, L.A.S., CONTE, M.H. i EGLINTON, G. (1995) Early diagenesis of lipid biomarker compound in North Atlantic sediments. *Paleoceanogr.* **10**, 627-642.
- MADUREIRA, L.A.S., EGLINTON, G. i CONTE, M.H. (1991) Early diagenesis of organic compounds in deep sea sediments. *15th Meeting of the European Association of Organic Geochemists: Poster Abstracts*, 243-247.
- MAHOOD, H.W. i ROGERS, I. H. (1975) Separation of resin acids from fatty acids in relation to environmental studies. *J. Chromatogr.* **109**, 281-286.
- MALLORY, F.B., GORDON, J.T. i CONNER, R.L. (1963) The isolation of a pentacyclic triterpenoid alcohol from a protozoan. *J. Am. Chem. Soc.* **85**, 1462-1363.
- MALOD, J.A. i MAUFFRET, A. (1990) Iberian plate motions during the Mesozoic. *Tectonophysics* **184**, 261-278.
- MANGO, F.D. (1994) The origin of light hydrocarbons in petroleum: Ring preference in the closure of carbocyclic rings. *Geochim. Cosmochim. Acta* **58**, 895-901.
- MARCH, J. (1992) Hidrolysis of amides. *Advanced Organic Geochemistry. Reactions, Mechanisms and Structure*. Quarta edició. New York, pp. 383-386. Wiley-Interscience Publication.
- MARTÍNEZ, B., TURQ, A., BALLESTER, J.A. i OMS, O. (1997) Fuente Nueva-3 (Orce, Granada, Spain) and the first human occupation of Europe. *J. Hum. Evol.* **33**, 611-620.
- MATSUDA, H. i KOYAMA, T. (1977) Early diagenesis of fatty acids in lacustrine sediments - II. A statistical approach to changes in fatty acid composition from recent sediments and some source materials. *Geochim. Cosmochim. Acta* **41**, 1825-1834.
- MATSUMOTO, G.I., AKIYAMA, M., WATANUKI, K. i TORII, T. (1990) Unusual distribution of long chain *n*-alkanes and *n*-alkenes in Antarctic lake soil. *Org. Geochem.* **15**, 403-412.
- MATSUMOTO, G., OHTANI, S., NAGASHIMA, H. i AIDA, K. (1993) Long-chain and branched hydrocarbons in algal and cyanobacterial mats from Antarctica oases. *An Organic Geochemistry. Poster Sessions from the 16th International Meeting on Organic Geochemistry*, Stavanger, Noruega, 22-24 September, 1993 (Editat per Øygaard K.), pp. 455-458. Falch Hurtigtrykk, Oslo.



- MATSUMOTO, G.I., TORII, T. i HANYA, T. (1982) High abundance of algal 24-ethylcholesterol in Antarctic lake sediment. *Nature* **299**, 52-54.
- MATSUMOTO, G.I., WATANUKI, K. i TORII, T. (1988) Hydroxyacids in Antarctic lake sediments and their geochemical significance. *Adv. Org. Geochem.* 1987 (Eds. Mattavelli i Novelli) 785-790. Pergamon.
- MCCAFFREY, M.A., FARRINGTON, J.W. i REPETA, D.J. (1991) The organic geochemistry of Peru margin surface sediments. II. Palaeoenvironmental implications of hydrocarbon and alcohol profiles. *Geochim. Cosmochim. Acta* **45**, 483-498.
- MCEVOY, J. (1983) The origin and diagenesis of organic lipids in sediment from the San Miguel Gap. Tesi Doctoral. Universitat de Bristol.
- MCEVOY, J. i GIGER, W. (1986) Origin of hydrocarbons in Triassic Serpiano oil shales. Hopanoids. *Org. Geochem.* **10**, 943-950.
- MCKIRDY, D.M., HEPPLWHITE, J., MICHAELSEN, B.H., MAZZOLENI, A. i BONE, Y. (1995) Origin of sapropels in Holocene lakes of the Coorong region, South Australia. A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 183-185. A.I.G.O.A., Donostia-San Sebastián, Espanya.
- MCLAFFERTY, F.W. i TURCEK, F. (1993) Interpretation of mass spectra. 4<sup>a</sup> ed. Mill Valley, California: University Science Books.
- MELLO, M.R., GANGLIANONE, P.C., BRASSELL, S.C. i MAXWELL, J.R. (1988) Geochemical and biological marker assessment of depositional environments using Brazilian offshore oils. *Mar. Petrol. Geol.* **5**, 205-223.
- MELLO, M.R., TRINDADE, L.A.F., DE GRANDE, S.M.B., PENTEADO, K.L. DE B., GUZMAN, M., HOLGUIN, N., GARCIA, C., REQUEJO, A.G., SASSEN, R., MCDONALD, T. NAVARRETE REYES, L.E., CAMPOS, P.G. i LÓPEZ QUINTERO, J.J.O. (1995) Comparative geochemical characterization of Gulf of Mexico oils derived from Jurassic to Miocene sources rocks: A biological marker and isotope approach. A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 65-67. A.I.G.O.A., Donostia-San Sebastián, Espanya.
- MENDOZA, Y.A., GULAÇAR, F.O., HU, L. i BUCHS, A. (1987) Unsubstituted and hydroxy substituted fatty acids in a recent lacustrine sediment (Lake Lemán, Geneva, Switzerland). *Inter. J. Environ. Anal. Chem.* **31**, 107-127.
- METZGER, P. i LARGEAU, C. (1994) A new type of ether lipid comprising phenolic moieties in *Botryococcus braunii*. Chemical structure and abundance, and geochemical implications. *Org. Geochem.* **22**, 801-814.



- MEYERS, P.A. (1997) Organic geochemical proxies of paleoceanographic, paleolimnologic, and paleoclimatic processes. *Org. Geochem.* **27**, 213-250.
- MEYERS, B. i ISHIWATARI, R. (1993) Lacustrine organic geochemistry: an overview of indicators of organic matter sources and diagenesis in lake sediments. *Org. Geochem.* **20**, 867-900.
- MEYER, B., SCHULTE, S. i RULLKÖTTER, J. (1997) Organic geochemical investigation of bound and free lipids in sediments from the Pakistan continental margin. A *Organic Geochemistry*. 18th International Meeting on Organic Geochemistry, Maastricht, The Netherlands, 22-26 September, 1997. Abstracts Part II, pp. 835-836. Forschungszentrum Jülich, Alemanya.
- MEYERS, P.A., LEENHEER, M.J., EADIE, B.J. i MAULE, S.J. (1984) Organic geochemistry of suspended and settling particulate matter in Lake Michigan. *Geochim. Cosmochim. Acta* **48**, 443-452.
- MICHAELSEN, B.H., KAMALI, M.R. i MCKIRDY, D.M. (1995) Unexpected molecular fossils from Early Cambrian marine carbonates of Officer Basin, South Australia. A *Organic Geochemistry: Developments and Applications to Energy, Climate, Environment and Human History*. 17th International Meeting on Organic Geochemistry, San Sebastián, Spain, 4-8 September, 1995. Abstracts, eds J. Grimalt i C. Dorronsoro, pp. 218-221. A.I.G.O.A., Donostia-San Sebastián, Espanya.
- MIDDELBURG, J.J., BAAS, M., TEN HAVEN, H.L. i DE LEEUW, J.W. (1993) Organic geochemical characteristics of sediments from Kau Bay. A *Organic Geochemistry. Poster Sessions from the 16th International Meeting on Organic Geochemistry*, Stavanger, Noruega, 22-24 September, 1993 (Editat per Øygard K.), pp. 413-417. Falch Hurtigtrykk, Oslo.
- MIKOLAJCZAK, K.L. i SMITH, JR., C.R. (1967) Pentacyclic Terpenes of *Jurinea anatolica* Boiss. and *Jurinea consanguinea* DC. Fruit. *Lipids* **2**, 127-132.
- MILLS, J.S., WHITE, R. i GOUGH, L.J. (1984) The chemical composition of Baltic amber. *Chem. Geol.* **47**, 15-39.
- MING-AN i DISNAR, J.R. (1995) Organic geochemical indicators of biological sulphate reduction in early diagenetic Zn-Pb mineralization: the Bois-Madame deposit (Gard, France). *Applied Geochem.* **10**, 419-435.
- MIRALLÈS, J., BARNATHAN, G., GALONNIER, R., SALL, T., SAMB, A., GAYDOU, E.M. i KORNPROBST, J.M. (1995) New Branched-Chain Fatty Acids from the Senegalese Corgonian *Leptogorgia piccola* (white and yellow morphs). *Lipids* **30**, 459-466.
- MIURA, V. i FULCO, A.J. (1975)  $\omega$ 1,  $\omega$ 2, and  $\omega$ 3 hydroxylation of long chain fatty acids amides and alcohols by a soluble enzym system from *Bacillus Megatherium*. *Biochim. Biophys. Acta* **388**, 305-317.

- MLADENOVA, K., YOCHKOVA, Y.A. i STOIANOVA-IVANOVA, B. (1983) Wax composition of the Kazalik and Damask roses. *Phytochem.* **22**, 943-945.
- MOLDOWAN, J.M., SEIFERT, W.K. i GALLEGOS, E.J. (1985) Relationship between petroleum composition and depositional environment of petroleum source rocks. *AAPG Bull.* **69**, 1255-1268.
- MOMZIKOFF, A., SANTUS, R. i GIRAUD, M. (1983) A study of the photosensitizing properties of seawater. *Mar. Chem.* **12**, 1-14.
- MONTHIOUX, M. i LANDAIS, P. (1989) Natural and artificial maturation of coal: non-hopanoid biomarkers. *Chem. Geol.* **77**, 71-85.
- MORRIS, R.J. i BRASSELL, S.C. (1988) Long-chain alkanediols: biological markers for cyanobacterial contributions to sediments. *Lipids* **23**, 256-258.
- MORRISON, R.I. i BICK, W. (1966) Long chain methyl ketones in soils. *Chem. Ind.* 596-597.
- MORRISON, R.I. i BICK, W. (1967) The wax fraction of soils: separation and determination of some components. *J. Sci. Food Agric.* **18**, 351-355.
- MUDGE, S.M., EAST, J.A., BEBIANNO, M.J. i BARREIRA, L.A. (1998) Fatty acids in the Ria Formosa Lagoon, Portugal. *Org. Geochem.* **29**, 963-977.
- NACCARATO, W.F., GELMAN, R.A., KAWALEK, J.C. i GILBERTSON, J.R. (1972) Characterization and metabolism of free fatty alcohols from *Escherichia coli*. *Lipids* **7**, 275-281.
- NETTING, A.G. i MACEY, M.J.K. (1971) The composition of ketones and secondary alcohols from *Brassica oleracea* waxes. *Phytochem.* **10**, 1917-1920.
- NEUNLIST, S. i ROHMER, M. (1985) Novel hopanoids from the methylotrophic bacteria *Methylococcus capsulatus* and *Methylomonas methanica*. *Biochem. J.* **231**, 635-639.
- NICHOLS, P.D. i JOHNS, R.B. (1985) Lipids of tropical seagrass *Thalassia hemprichii*. *Phytochem.* **24**, 81-84.
- NICHOLS, P.D. i JOHNS, R.B. (1986) The lipid chemistry of sediments from the St Lawrence estuary. Acyclic unsaturated long chain ketones, diols and ketone alcohols. *Org. Geochem.* **9**, 25-30.
- NICHOLS, P.D., KLUMPP, D.W. i JOHNS, R.B. (1982) A study of food chain in seagrass communities-I. Lipid components of the seagrass *Posidonia australis* and *Heterozostera tasmanica* as indicators of carbon source. *Phytochem.* **21**, 1613-1621.



- NICHOLS, P.D., PALMISANO, A.C., SMITH, G.A. i WHITE, D.C. (1986) Lipids of the Antarctic sea-ice diatoms *Nitzschia cylindrus*. *Phytochem.* **25**, 1649-1653.
- NICHOLS, P.D., VOLKMAN, J.K., HALLEGRAEFF, G.M. i BLACKBURN, S.I. (1987) Sterols and fatty acids of the red tide flagellates *Heterosigma akashiwo* and *Chattonella antiqua* (Raphidophyceae). *Phytochem.* **26**, 2537-2541.
- NICHOLS, P.D., VOLKMAN, J.K., PALMISANO, A.C., SMITH, G.A. i WHITE, D.C. (1988) Occurrence of an isoprenoid C<sub>25</sub> diunsaturated alkene and high neutral lipid content in Antarctic sea ice diatom communities. *J. Phycol.* **24**, 90-96.
- NIP, M., TEGELAAR, E.W., BRINKHUIS, H., DE LEEUW, J.W., SCHENCK, P.A. i HOLLOWAY, P.J. (1986) Analysis of modern and fossil plant cuticles by Curie point PyGC and Curie point PyGC-MS: Recognition of a new highly aliphatic and resistant biopolymer. *Org. Geochem.* **10**, 769-778.
- NISHIMOTO, S. (1974) A taxonomic study of *n*-alkanes in aquatic plants. *J. Sci. Hiroshima Univ. Ser. A* **38**, 159-163.
- NISHIMURA, M i KOYAMA, T. (1977) The occurrence of stanols in various living organisms and the behaviour of sterols in contemporary sediments. *Geochim. Cosmochim. Acta* **41**, 379-385.
- NOBLE, R.A., ALEXANDER, R., KAGI, R.I. i KNOX, J. (1985a) Tetracyclic diterpenoid hydrocarbons in some Australian coals, sediments and crude oils. *Geochim. Cosmochim. Acta* **49**, 2141-2147.
- NOBLE, R.A., KNOX, J., ALEXANDER, R. i KAGI, R.I. (1985b) Identification of Tetracyclic Diterpene Hydrocarbons in Australian Crude Oils and Sediments. *J. Chem. Soc., Chem. Commun.*, 32-33.
- NURMINEN, T. i SUOMALAINEN, H. (1971) Occurrence of long chain fatty acid and glycolipids in the cell envelope fractions of bakers's yeasts. *Biochem. J.* **125**, 963-969.
- ODDEN, W., PATIENCE, R.L. i VAN GRAAS, G.W. (1997) A study of the light hydrocarbon composition of source rocks and test fluids from offshore Mid-Norway. *A Organic Geochemistry*. 18th International Meeting on Organic Geochemistry, Maastricht, The Netherlands, 22-26 September, 1997. Abstracts Part II, pp. 557-558. Forschungszentrum Jülich, Alemanyà.
- OGIHARA, S. i ISHIWATARI, R. (1997) Comparison of hydrocarbon distributions isolated from non-altered and hydrothermally affected phosphorite nodules from Kusu basin, northern Kyushu, Japan. *A Organic Geochemistry*. 18th International Meeting on Organic Geochemistry, Maastricht, The Netherlands, 22-26 September, 1997. Abstracts Part I, pp. 213-214. Forschungszentrum Jülich, Alemanyà.