

Zeitschrift: Eclogae Geologicae Helvetiae
Herausgeber: Schweizerische Geologische Gesellschaft
Band: 87 (1994)
Heft: 1

Artikel: Depositional trends in the Valdorbia Section (central Italy) during the Early Jurassic, as revealed by micropaleontology, sedimentology and geochemistry
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Bibliographie: References
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DOI: <https://doi.org/10.5169/seals-167447>

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REFERENCES

- AGER, D. V. 1974: Storm deposits in the Jurassic of the Moroccan High Atlas. *Palaeogeogr., Palaeoclimatol., Palaeoecol.* 15, 83–93.
- ARIAS, C. F. 1991: Asociaciones de Ostrácodos del Domeriense superior y Toarciense inferior de la Cordillera Ibérica. *Coloquios de Paleontología* 43, 79–99.
- BARAHONA, E. 1974: Arcillas de ladrillería de la provincia de Granada: evaluación de algunos ensayos de materias primas. Ph. D. Thesis. Univers. of Granada, Spain (unpublished).
- BARCHI, M., LAVECCHIA, G. & MINELLI, G. 1989: Sezione geologica bilanciata attraverso il sistema a pieghe Umbro-Marchigiano: 2 – La sezione Scheggia-Serra S. Abbondio. *Boll. Soc. Geol. Ital.* 108, 69–81.
- BARTENSTEIN, H. 1974: Upper Jurassic-Lower Cretaceous primitive arenaceous Foraminifera from DSDP Sites 259 and 261, eastern Indian ocean. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office, (Ed. by J. J. Veevers, J. R. Heirtzler, et al.) 27, 683–695.
- BARTOLINI, A., NOCCHI, M., BALDANZA, A. & PARISI, G. 1992: Benthic life during the early Toarcian anoxic event in the southwestern Tethyan Umbria-Marche Basin, Central Italy. *Studies in Benthic Foraminifera, Benthos '90*, Sendai, Japan, Tokai Univ. Press 323–338.
- BASOV, I. A. & KRASHENINNIKOV, V. A. 1983: Benthic Foraminifera in Mesozoic and Cenozoic sediments of the Southwestern Atlantic as an indicator of paleoenvironment, Deep Sea Drilling Project Leg 71. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by W. J. Ludwig, V. A. Krasheninnikov, et al.) 71 (2), 739–787.
- BATHURST, R. G. C. 1975: *Carbonate sediments and their diagenesis*. Elsevier, Amsterdam.
- 1987: Diagenetically enhanced bedding in argillaceous platform limestones: stratified cementation and selective compaction. *Sedimentology* 34, 749–778.
- BAUDIN, F., HERBIN, J. P., BASSOULET, J. P., DERCOURT, J., LACHKAR, G., MANIVIT, H. & RENARD, M. 1990: Distribution of organic matter during the Toarcian in the Mediterranean Tethys and Middle East. In: *Deposition of Organic facies* (Ed. by A. Y. Huc), AAPG Studies in Geology 30, 73–91.
- BERNARD, J. M. 1986: Characteristic assemblages and morphologies of benthic foraminifera from anoxic, organic-rich deposits: Jurassic through Holocene. *Journ. Foram. Res.* 16 (3), 207–215.
- BIELECKA, W. & POZARYSKA, W. 1954: Micropaleontological stratigraphy of the Upper Malm in Central Poland. *Inst. Geol. Prace* 12, 139–206.
- BLOOS, G. 1982: Shell beds in the lower Lias of south Germany: facies and origin. In: *Cyclic and Event stratification* (Ed. by G. Einsele & A. Seilacher), Springer-Verlag, Berlin, Heidelberg, New York, 223–239.
- BOLTOSKOY, E. & WRIGHT, R. 1976: Recent foraminifera. Dr. W. Junk, The Hague.
- BOUMA, A. 1962: Sedimentology of some flysch deposits. Amsterdam Elsevier Sci. Publ., pp., 1–168.
- BRENNER, R. L. & DAVIES, D. K. 1973: Storm-generated coquinoid sandstone: genesis of high energy marine sediments from the Upper Jurassic of Wyoming and Montana. *Geol. Soc. of Am. Bull.* 84, 1685–1698.
- BROMLEY, R. G. 1990: Trace fossils, biology and taphonomy. Unwin Hyman Ed., London.
- BROMLEY, R. G. & EKDALE, A. A., 1984: Chondrites: a trace fossil indicator of anoxia in sediments. *Science* 224, 872–874.
- CECCA, F., CRESTA, S., PALLINI, G. & SANTANTONIO, M. 1990: Il Giurassico di Monte Nerone (Appennino Marchigiano, Italia Centrale): biostratigrafia, litostratigrafia ed evoluzione paleogeografica. *Mem. Descr. Carta Geol. d'Italia* 40, 51–126.
- CENTAMORE, E., CHIOCCHINI, M., DEIANA, G., MICARELLI, A. & PIERUCCINI, V. 1969: Considerazioni preliminari su alcune serie mesozoiche dell'Appennino Umbro-Marchigiano. *Mem. Soc. Geol. It.* 8 (3), 237–263.
- 1971: Contributo alla conoscenza del Giurassico dell'Appennino Umbro-Marchigiano. *Studi Geol. Camerti* 1, 7–89.
- CHAMLEY, H. 1989: *Clay Sedimentology*. Springer Verlag, New York.
- CHAMNEY, T. P. 1976: Foraminiferal morphogroup symbol for paleoenvironmental interpretation: Artic America, Albian continental margin. In: *Maritime sediments* (Ed. by Ch. T. Shafer & B. R. Pelletier), Spec. Publ. 1, 585–624.
- CHANNELL, J. E. T., LOWRIE, W., PIALLI, P. & VENTURI, F. 1984: Jurassic magnetic stratigraphy from Umbrian (Italian) land sections. *Earth and Planetary Science Letters*, Elsevier Sc. Publ. 309–325.
- COLACICCHI, R. & BALDANZA, A. 1986: Carbonate turbidites in a Mesozoic pelagic basin: Scaglia Formation, Apennines – comparison with siliciclastic depositional models. *Sedimentary Geology* 48, 81–105.
- COLACICCHI, R. & BIGOZZI, A. 1992: Tentative event stratigraphy on a carbonate platform-basin system: Jurassic of Central Apennine. In: *SEPM/IAS Conference Carbonate Stratigraphic Sequences Boundary and Associated Facies* (Abstract), Laseu Spain 1–3 Sept. 1992.

- COLACICCHI, R., NOCCHI, M., PARISI, G., MONACO, P., BALDANZA, A., CRESTA, S. & PALLINI, G. 1988: Palaeoenvironmental analysis from Lias to Malm (Corniola to Maiolica Formations) in the Umbria-Marche basin, Central Italy (preliminary report). In: 2nd Int. Symp. on Jurassic Stratigraphy (Ed. by R. B. Rocha & A. F. Soares), Sept. 1987, Lisboa 2, 717–728.
- COLACICCHI, R., PASSERI, L. & PIALLI, G. 1970: Nuovi dati sul Giurese Umbro-Marchigiano ed ipotesi per un suo inquadramento regionale. *Mem. Soc. Geol. It.* 9, 839–874.
- CONTI, M. A. & CRESTA, S. 1982: Considerazioni stratigrafiche e paleoecologiche sui “livelli a Posidonia” (AUCT.) dell’Appennino Umbro-Marchigiano. *Paleontologia stratigrafica ed Evoluzione*, Quaderno 2, 73–80.
- CONTI, M. A., & MONARI, S., 1992: Thin-shelled bivalves from the Jurassic Rosso Ammonitico and Calcarei a Posidonia Formations of the Umbrian-Marchean Apennine (central Italy). *Paleopelagos* 2, 193–213.
- COPESTAKE, P. 1989: Jurassic. Offprints from Jenkins/Murray Stratigraphical Atlas of Fossil Foraminifera 2/e 6, 125–272.
- CRESTA, S., CECCA, F., SANTANTONIO, M., PALLINI, G., BRÖNNIMANN, P., BALDANZA, A., COLACICCHI, R., MONACO, P., NOCCHI, M., PARISI, G. & VENTURI, F. 1988: Stratigraphic correlations in the Jurassic of the Umbria-Marche Apennines (Central Italy). In: 2nd Int. Symp. on Jurassic Stratigraphy (Ed. by R. B. Rocha & A. F. Soares), Sept. 1987, Lisboa 2, 729–744.
- CRESTA, S., PALLINI, G. & VENTURI, F. 1989: Associazioni ad Ammoniti nella sezione giurassica di Valdorbìa. In: *Mesozoic-Cenozoic stratigraphy in the Umbria-Marche area* (Ed. by S. Cresta, S. Monechi & G. Parisi), *Mem. descr. Carta geol. d’Italia*. 39, 89–94.
- CUBAYNES, R., BOUTET, C., DELFAUD, J. & FAURÉ, PH. 1984: La megasequence d’ouverture du Lias Quercynois (bordure sud-ouest du Massif central Français. *Bull. Elf. Aquit.* 8 (2), 333–370.
- CUBAYNES, R., REY, J., RUGET, C., COURTINAT, B. & BODERGAT, A. M. 1990: Relations between systems tracts and micropaleontological assemblages on a Toarcian carbonate shelf (Quercy, southwest France). *Bull. Soc. géol. France* 6 (6), 989–993.
- CUBAYNES, R. & RUGET, CH. 1987: Relation séquence d’ouverture – déroulement du genre *Lenticulina* (Foraminifère). Un exemple dans le Domerien du Sud-Quercy. *Cahiers Inst. Catho. Lyon, sér. Sci* 1, 113–122.
- CUBAYNES, R., RUGET, C. & NICOLLIN, J. P. 1991: La population, marqueur de l’environnement et signal des variations eustatiques. *Cahiers Univ. Catho. Lyon, sér. Sci.* 4, 161–170.
- CUBAYNES, R., RUGET, C. & REY, J. 1989: Essai de caractérisation des prismes de depot d’origine eustatiques par les associations de Foraminifères benthiques: exemple du Lias moyen et supérieur sur la bordure est du Bassin aquitain. *C. R. Acad. Sci. Paris* 308 (2), 1517–1522.
- CURTOIS, CH. & HOFFERT, M. 1979: Distribution des terres rares dans les sédiments superficiels du Pacifique sud-est. *Bull. Soc. géol. France* 19, 1245–1251.
- DAM, G. 1990: Palaeoenvironmental significance of trace fossils from the shallow marine Lower Jurassic Neill Klintor Formation, East Greenland. *Palaeogeogr., Palaeoclimatol., Palaeoecol.* 79, 221–248.
- DONOVAN, D.T. 1958: The Ammonites Zones of the Toarcian (Ammonitico Rosso Facies) of southern Switzerland and Italy. *Eclog. Geol. Helv.* 51, 33–60.
- DUKE, W. L. 1985: Hummocky cross-stratification, tropical hurricanes, and intense winter storms. *Sedimentology* 32, 167–194.
- EBERLI, G. P. 1991: Calcareous turbidites and their relationship to sea-level fluctuations and tectonism. In: *Cycles and Events in Stratigraphy* (Ed. by G. Einsele, W. Ricken & A. Seilacher), Springer-Verlag, Berlin, Heidelberg 1991, 340–359.
- EINSELE, G. 1991: Submarine mass flow deposits and turbidites. In: *Cycles and Events in Stratigraphy* (Ed. by G. Einsele, W. Ricken & A. Seilacher), Springer-Verlag, Berlin, Heidelberg 1991, 313–339.
- EKDALE, A. A. 1985: Paleoecology of the marine endobenthos. *Palaeogeogr., Palaeoclimatol., Palaeoecol.* 50, 63–81.
- ELMI, S. 1981a: Classification typologique et genetique des Ammonitico-Rosso et des facies noduleux ou grumeleux: essai de synthese. In: *Rosso Ammonitico Symposium Proc.* (Ed. by A. Farinacci & S. Elmi), Ediz. Tecnoscienza, Roma 233–249.
- 1981b: Sedimentation rythmique et organisation sequentielle dans les Ammonitico-Rosso et les facies associes du Jurassique de la Mediterranee occidentale. Interpretation des grumeaux et des nodules. In: *Rosso Ammonitico Symposium Proc.* (Ed. by A. Farinacci & S. Elmi) Ediz. Tecnoscienza, Roma 251–300.
- FARINACCI, A. 1965: I Foraminiferi di un livello marnoso nei calcari diasprigni del Malm (M. Martani, Umbria). *Geol. Rom.* 4, 229–258.

- FURINACCI, A. & ELMI, S. (Eds.) 1981: Rosso Ammonitico Symposium Proceedings. Edizioni Tecnoscienza, Roma.
- FARINACCI, A., LORD, A., PALLINI, G. & SCHIAVINOTTO, F. 1978: The depositional environment of the Domerian-Toarcian sequence of Strettura (Umbria). *Geol. Rom.* 17, 303–323.
- FARINACCI, A., MARIOTTI, N., NICOSIA, U., PALLINI, G. & SCHIAVINOTTO, F. 1981: Jurassic sediments in the Umbro-Marchean Apennines: an alternative model. In: Rosso Ammonitico Symposium Proc. (Ed. by A. Farinacci & S. Elmi) Ediz. Tecnoscienza, Roma 335–398.
- FAZZINI, P. & MANTOVANI, M. P. 1965: La geologia del Gruppo di M. Subasio. *Boll. Soc. Geol. It.* 84, 71–142.
- GALLITELLI WENDT, M. F. 1969: Ammoniti e stratigrafia del Toarciano Umbro-Marchigiano (Appennino centrale). *Boll. Soc. Paleont. It.* 8 (1), 11–62.
- GAVSHIN, V. M. 1991: Sea water as a source of metals in black shales. Proc. of the SGA Meeting: source, transport and deposition of metals. Nancy 519–522.
- GIANNINI, E., LAZZAROTTO, A. & ZAMPI, P. 1970: Studio stratigrafico e micropaleontologico della Montagna dei Fiori (Ascoli Piceno-Teramo). *Mem. Soc. Geol. It.* 9 (1), 29–54.
- GORDON, W. A. 1970: Biogeography of Jurassic Foraminifera. *Geol. Soc. Am. Bull.* 81 (6), 1689–1703.
- GRADSTEIN, F. M. 1983: Paleocology and stratigraphy of Jurassic abyssal foraminifera in the Blake-Bahama Basin, Deep Sea Drilling Project Site 534. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by R. E. Sheridan, F. M. Gradstein, et al.) 76, 537–559.
- GRADSTEIN, F. M. & BERGGREN, W. A. 1981: Flysch-type agglutinated foraminifera and the Maestrichtian to Paleogene history of the Labrador and North Seas. *Marine Micropaleont.* 6, 211–268.
- HALLAM, A. 1967: The depth significance of shales with bituminous laminae. *Marine Geology* 5, 481–494.
- 1988: A reevaluation of Jurassic eustasy in the light of new data and the revised Exxon curve. In: *Sea-level changes – An integrated Approach*, SEPM, Spec. Publ. N°42, 261–273.
- HARMS, J. C., SOUTHARD, J. B., SPEARING, D. R. & WALKER, R. G. 1975: Depositional environments as interpreted from primary sedimentary structures and stratification sequences. *Soc. Econ. Paleont. Mineral., Tulsa, Short Course N°2*.
- JENKYN, H. C. 1988: The early Toarcian (Jurassic) anoxic event: stratigraphic, sedimentary and geochemical evidence. *Amer. Journ. of Science* 288, 101–151.
- & CLAYTON, C. 1986: Black shale and carbon isotope in pelagic sediments from the Tethyan lower Jurassic. *Sedimentology* 33, 87–106.
- JOHNSON, B. 1976: Ecological ranges of selected Toarcian and Domerian (Jurassic) foraminiferal species from Wales. *1st Int. Symposium on Benthonic Foraminifera of Continental Margins. Maritime Sediments Special Publ. 1 B*, 545–556.
- KAIHO, K. 1989: Morphotype changes of deep-sea benthic foraminifera during Cenozoic Era and their paleoenvironmental implications. *Fossils & Strata* 47, 1–23.
- 1991: Global changes of Paleogene aerobic/anaerobic benthic foraminifers and deep-sea circulation. *Palaeogeogr., Palaeoclimatol., Palaeoecol.* 83, 65–85.
- KAUFFMAN, E. G. 1981: Ecological reappraisal of the German Posidonienschiefer (Toarcian) and the stagnant basin model. In: *Communities of the Past* (Ed. by J. Gray, A. J. Boucot and W. B. N. Berry), 311–381.
- KOEHN ZANINETTI, L. 1969: Les foraminifères du Trias de la région de l'Almtal (Haute – Autriche). *Jahrb. Geol. Bund.* 14, 1–155.
- KREISA, R. D. 1981: Storm-generated sedimentary structures in subtidal marine facies with examples from the middle and upper Ordovician in southwestern Virginia. *Journ. of Sediment. Petrol.* 51, 823–848.
- KREISA, R. D. & BAMBACH, R. K. 1982: The role of storm processes in generating shell beds in Paleozoic shelf environments. In: *Cyclic and Event stratification* (Ed. by G. Einsele & A. Seilacher), Springer-Verlag, Berlin, Heidelberg, 200–207.
- KUZNETSOVA, K. I. 1974: Distribution of benthonic foraminifera in Upper Jurassic and Lower Cretaceous deposits at Site 261, DSDP Leg 27, in the eastern Indian Ocean. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by J. J. Veevers, J. R. Heirtzler, et al.) 27, 673–681.
- KUZNETSOVA, K. I. & SEIBOLD, I. 1978: Foraminifers from the Upper Jurassic and Lower Cretaceous of the eastern Atlantic (DSDP Leg 41, Sites 367 and 370). In: *Init Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by Y. Lancelot, E. Seibold et al.) 41, 515–537.
- LEISCHNER, W. 1961: Zur Kenntnis der Mikrofauna und -flora der Salzburger Kalkalpen. *N. Jb. Geol. Paläont. Abh.* 112, 1–47.
- LIPINA, O. A. 1961: Zavisimost foraminifer ot fathij v otlozhenijakh famenskogo jarusa verkhnego devona i turnejnskogo jarusa karbona zapadnogo sklona Urala. *Vopr. Micropal.* 5, 147–161.

- LOEBLICH, A. R., Jr. & TAPPAN, H. 1988: Foraminiferal Genera and their classification. Van Nostrand Reinhold Company Inc., New York, 869 Plates/separate volume.
- LØFOLDLI, M. & THUSU, B. 1979: Micropaleontological studies of the Upper Jurassic and Lower Cretaceous of Andoya, Northern Norway. *Palaeontology* 22, (2), 413–425.
- LOWE, D. R. 1982: Sediment gravity flows: II. Depositional models with special reference to the deposits of high-density turbidity currents. *Journ. Sedim. Petrol.* 52, 279–297.
- LUTERBACHER, H. 1972: Foraminifera from the Lower Cretaceous and Upper Jurassic of the northwestern Atlantic. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by C. D. Hollister, J. I. Ewing, et al.) 11, 561–593.
- MARSAGLIA, K. M. & KLEIN, G. de V. 1983: The paleogeography of Paleozoic and Mesozoic storm depositional system. *Journ. of Geology* 91, 117–142.
- MOLINA, J. M., RUIZ-ORTIZ, P. A. & VERA, J. A. 1987: Capas de tormentas (tempestitas) en el Jurásico del Subbético Externo (Cordilleras Béticas). *Acta Geologica Hispanica* 21–22, 167–175.
- MONACO, P. 1992: Hummocky cross-stratified deposits and turbidites in some sequences of the Umbria-Marche area (central Italy) during the Toarcian. *Sediment. Geol.* 77, 123–142.
- 1993: Calcareni bioclastiche a stratificazione incrociata “hummocky” e altri depositi di tempesta in alcune sequenze Toarciane dell’Appennino Umbro-Marchigiano. *Paleopelagos* 2, 5–19.
 - in press a: Trace-fossil assemblages in some Toarcian regressive sequences of the Umbria-Marche area (central Italy). *Reunión Mon. de S. G. E., “Biosedimentation”*, Oviedo, 20–22 Feb. 1992.
 - in press b: Hummocky cross-stratification and trace-fossils in the middle Toarcian of some sequences of Umbria-Marche Apennines. 3ème Symp. Intern. de Stratigr. du Jurassique, Poitiers, 20–29 Sept. 1991, *Geobios*. 1992.
 - in press c: Trace-fossil communities and substrate characteristics of some Jurassic pelagic deposits in the Umbria-Marche basin, central Italy. E. P. A., Lyon, 7–9 July 1993, *Geobios*. 1993.
- MORRIS, P. H. 1982: Distribution and palaeoecology of Middle Jurassic Foraminifera from the Lower Inferior Oolite of the Cotswolds. *Palaeogeogr., Palaeoclim., Palaeoecol.* 37, 314–319.
- MURRAY, J. 1984: Benthic Foraminifera: some relationships between ecological observations and palaeological interpretations. *Benthos '83, Sec. Int. Symp. Benthic Foram.* (Pau, 1983), 465–469.
- MUTTI, E. 1992: Facies con hummocky cross-stratification prodotte da flussi gravitativi in sistemi confinati di fandelta di acque basse (shelf-type fan deltas). In: 76a Riun. est. Soc. Geol. It.: “l’Appennino settentrionale”, Firenze, 21–23 Sett. 1992 (abstract), 102–105.
- NAGY, J. & JOHANSEN, H. O. 1991: Delta-influenced foraminiferal assemblages from the Jurassic (Toarcian-Bajocian) of the northern North Sea. *Micropaleontology* 37 (1), 1–40.
- NAGY, J., PILSKOG, B. & WILHELMSSEN, R. M. 1990: Facies controlled distribution of Foraminifera in the Jurassic Northern Sea Basin. In: *Paleoecology, Biostratigraphy, Paleoceanography and Taxonomy of Agglutinated Foraminifera*, (Ed. by C. Hemleben, et al.), The Netherlands, 621–657.
- NICOLLIN, J. P. & RUGET, C. 1988: Microfaune du Toarcien inférieur (Zone à *Tenuicostatum* et *Serpentinum*). *Benthos '86. Rev. Paléob. Spec. Publ.* 2, 183–189.
- NOCCHI, M. 1992: Associazioni a microforaminiferi bentonici del Bacino Umbro-Marchigiano e loro variazioni durante il Lias. *Paleopelagos* 2, 37–53.
- NOCCHI, M. & BARTOLINI A., in press. Investigation of Late Domerian-Early Toarcian *Lagenina* and *Glomospirella* assemblages in the Umbria-Marche Basin (Central Italy). 3rd Intern. Symp; Jura. Strat., Poitiers, France. 1991.
- NOCCHI, M., COLACICCHI, R., MONACO, P., BALDANZA, A. & PARISI, G. 1991. Benthic life and sediments during the early Toarcian anoxic event in the southwestern Tethyan Umbria-Marche basin, central Italy. VI E. U. G., *Terra Cognita*, Vol. 3, N 1, 27/4 Strasbourg, March 1991, p. 291.
- ORTEGA-HUERTAS, M., MONACO, P. & PALOMO, I. 1993: First data on clay mineral assemblages and geochemical characteristics of Toarcian sedimentation in the Umbria-Marche basin (central Italy). *Clay Minerals* 28, 297–310.
- PASSERI, L. 1971: Stratigrafia e sedimentologia dei calcari Giurassici del m.te Cucco (Appennino Umbro). *Geologica Romana* 10, 93–130.
- PIALLI, G. 1969a: Un episodio marnoso del Lias superiore nel bacino Umbro-Marchigiano: le Marne del M. Serrone. *Boll. Soc. Natur. Napoli* 78, 3–23.
- 1969b: Geologia delle Formazioni Giuresi dei monti ad est di Foligno (Appennino Umbro). *Geologica Romana* 9, 1–30.

- PIPER, D. J. W. & STOW, D. A. V. 1991: Fine-grained turbidites. In: *Cycles and Events in Stratigraphy* (Ed. by G. Einsele, W. Ricken & A. Seilacher), Springer-Verlag, Berlin, Heidelberg, 360–376.
- PRAVE, A. R. & DUKE, W. L. 1990: Small-scale hummocky cross-stratification in turbidites: a form of antidune stratification? *Sedimentology* 37, 531–539.
- RADOICIC, R. 1966: Microfacies du Jurassique des Dinarides externes de la Yougoslavie. *Geologija* 9, 377.
- REALE, V. 1988: Biostratigrafia a nannofossili calcarei, biogeografia e paleogeografia del Giurassico inferiore e medio nelle successioni dell'Appennino Umbro-Marchigiano. Unpublished thesis, Dip. Sc. della Terra, Firenze.
- 1989: Jurassic calcareous nannofossils and benthic foraminifera of the Valdorbia section. In: *Mesozoic-Cenozoic stratigraphy in the Umbria-Marche area* (Ed. by S. Cresta, S. Monechi & G. Parisi), *Mem. Descr. Carta Geol. Ital.* 39, 80–88.
- REALE, V., BALDANZA, A., MONECHI, S. & MATTIOLI, E. 1991: Calcareous nannofossil biostratigraphic events from the Early-Middle Jurassic sequences of the Umbria-Marche area (central Italy). *Mem. Sc. Geol. Univ. Padova* 43, 41–75.
- RHOADS, D. C. & MORSE, J. W. 1971: Evolutionary and ecologic significance of oxygen-deficient marine basins. *Lethaia* 4, 413–428.
- RIEGRAF, W., LUTERBACHER, H. & LECKIE, R. M. 1984: Jurassic Foraminifers from the Mazagan Plateau, Deep Sea Drilling Project Site 547, Leg 79, off Morocco. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by K. Hinz, E. L. Winterer, et al.) 79, 671–692.
- RONOV, A. B., BALASHOV, Y. A. & MIGDISOV, A. A. 1967: Geochemistry of the rare earths in the sedimentary cycle. *Geochem. Int.* 4, 1–17.
- RUGET, C. 1980: Evolution et biostratigraphie des Lagénideés (Foraminifères) dans le Lias de l'Europe occidentale. *Bull. Soc. géol. France* 22 (4), 623–626.
- SAVRDA, C. E. & BOTTJER, D. J. 1986: Trace-fossil model for reconstruction of paleo-oxygenation in bottom waters. *Geology* 14, 3–6.
- 1989: Trace-fossil model for reconstructing oxygenation histories of ancient marine bottom waters: application to upper cretaceous Niobrara Formation, Colorado. *Palaeogeogr., Palaeoclimatol., Palaeoecol.* 74, 49–74.
- SCARSELLA, F. 1951: Un aggruppamento di pieghe dell'Appennino Umbro-Marchigiano. *Boll. Serv. Geol. d'Ital.* 73, 307–320.
- SCHULTZ, L. G. 1964: Quantitative interpretation of mineralogical composition from x-ray and chemical data for the Pierre Shale. *U.S. Geol. Surv. Prof. Papers* 391-C, 1–31.
- SEILACHER, A. 1962: Paleontological studies on turbidite sedimentation and erosion. *Journ. Geol.* 70, 227–234.
- 1964: Sedimentological classification and nomenclature of trace fossils. *Sedimentology* 3, 253–256.
- SLITER, W. V. 1980: Mesozoic foraminifers and deep-sea benthic environments from Deep Sea Drilling Project Sites 415 and 416, eastern North Atlantic. In: *Init. Repts. DSDP*, Washington, U.S. Govt. Printing Office (Ed. by Y. Lancelot, E. L. Winterer, et al.) 50, 353–427.
- SPECHT, R. W. & BRENNER, R. L. 1979: Storm-wave genesis of bioclastic carbonates in upper Jurassic epicontinental mudstones, east-central Wyoming. *Journ of Sedim. Petrol.* 49, 1307–1322.
- STAM, B. 1986: Quantitative analysis of Middle and Late Jurassic Foraminifera from Portugal and its implications for the Grand Banks of Newfoundland. *Utrecht Microp. Bull.* 34, 1–168.
- VAN MORKHOVEN, F. P. C. M. & BERGGREN, W. A. 1986: Cenozoic cosmopolitan deep-water benthic Foraminifera. *Bull. Cent. Res. Explor. Prod. Elf-Aquitaine* 11, 1–421.
- VENTURI, F. 1981: Le "Rosso Ammonitico" du Toarcien inferieur dans quelques localités de l'Apennin de Marche-Ombrie. Consequences sur la stratigraphie et la taxonomie des Ammonitina. In: *Rosso Ammonitico Symposium Proc.* (Ed. by A. Farinacci & S. Elmi), Ediz. Tecnoscienza, Roma, 581–602.
- in press: Biostratigrafia del Toarciano inferiore dei M. Martani. *Boll. Soc. Pal. It.*
- WALKER, R. G. 1984: Shelf and shallow marine sands. In: *Facies Models 2nd Edition* (Ed. by R. G. Walker), *Geoscience Canada Reprint Series* 1, May 1984, 141–170.
- WALZBUCK, J. P. 1982: Bedding types of the Toarcian black shales in NW-Greece. In: *Cyclic and Event Stratification* (Ed. by E. Einsele & A. Seilacher), Springer-Verlag, Berlin, Heidelberg, 512–525.
- WERNLI, R. 1971: *Planii involuta carinata* Leischer, 1961 (Foraminifère) dans l'Aalénien Supérieur du Jura Méridional (France). *Arch. Sc. Genève* 24, 219–226.

Manuscript received April 8, 1993

Revision accepted October 7, 1993