Trace Fossil Observation from Convention Core

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Conventional cores are normally described for their lithology, sedimentary structures and fossil contents. One of the primary aims is to determine a paleodepositional environment and to collect reservoir and seal properties information. The understanding of biogenic sedimentary structures fits nicely into an attempt to fill part of this puzzle. The following note brings attention to some of the key elements in working with biogenic structures.

Biogenic structures are sedimentary structures produced by the activity of organisms. They are commonly described based on the degree of destruction to the primary sedimentary structures, such as slightly bioturbated, highly bioturbated or completely bioturbated (100%). However, the identification of individually distinctive biogenic structures (also called trace fossils or ichnofossils) including tracks, trails, burrows, borings, coprolites etc., is now becoming the common practice in describing biogenic structures. Once an individual trace fossil has been recognized, it is then related to the behavior of the trace itself, whether it is a resting trace, dwelling trace, feeding trace or grazing trace. They are then grouped into recurring ichnofacies, which reflect adaptations of trace-making organisms to environmental factors. Since trace fossils are records of the behavior of active, in-situ organisms, they represent potential environmental indicator such as substrate consistency, food supply, hydrodynamic energy, salinity, and oxygen level (Pemberton, 1995). This collection of information is then used to improve our interpretation of paleodepositional environment.

Identification of individual trace fossils in conventional core can be difficult. Often, we only observe a portion of the trace fossil due to the way the core was cut. This applies to vertical sections of both the curved outer surface and the flat surface of a slabbed core. Recognition of portions of a particular trace fossil cut at various angles is a practiced skill (Pemberton, 1995). Typically, more than one view is essential to assure an accurate identification. Horizontal burrows be better recognized in cores compared to vertical burrows since the possibility of the core cut parallel to the burrows is less. Figure 1 is a sketch and core photo of *Ophiomorpha**, which represents the dwelling burrows of decapod crustaceans, including numerous species of thalassinidean shrimp. Most of the time, only the horizontal portion of this trace fossil can easily be observed in a core. *Ophiomorpha** It is commonly associated with the *Skolithos*** ichnofa-

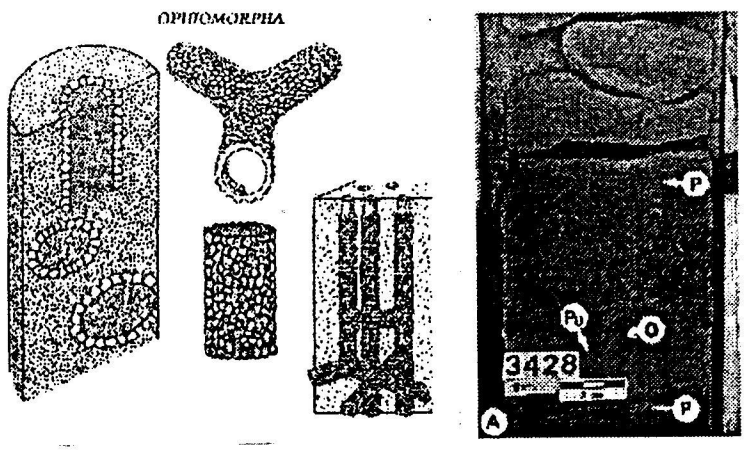


Fig. 1 Ophiomorpha in sketch (Pemberton, 1996) and in core (0)

* *Ophiomorpha*: A three dimensional burrow system, vertical and horizontal; cylindrical tunnels (0.5-3 cm. diameter), branching generally at acute angles; with local welling close to or at points of branching; tunnels internally smooth, but the outer surface or the burrow looks like a corn, consists of clay pellets as material of the wall.

** *Skolithos*: The most common type of dwelling structure in deltaic to marine sequence. The shape is like a straight tube of pipes perpendicular to bedding surface, and parallel to each other, interpreted as made by worms or by shells.

****Thallasinoides*: Cylindrical burrows forming 3 dimensional branching sysems consisting of horizontal networks connected to surface by more or less vertical shafts; diameters are about 10-15 mm.; regularly branching, "Y" shaped bifurcations; in horizontal systems forming polygons.



Fig. 2. Core photo of *Glossifungites* ichnofacies which is pretty much dominated by firm ground Thallasionides

cies and can be found in prolific numbers in a marine shoreface environment. It is also found in brackish water, sandy substrates including estuaries and tidal shoals (Pemberton, 1995). Figure 2 is a core photo of *Glossifungites* ichnofacies. This particular ichnofacies is commonly associated with erosional surfaces especially in a marine-influenced siliciclastic interval. It is a substrate-controlled assemblage of trace fossils, characterized by robust, sharp-walled (locally scratch-marked), unlined, passively filled, vertical to subvertical burrows, excavated into semi-consolidated (firmground) substrates (MacEachern et al., 1992). Individual trace fossil includes *Thallasinoides****, *Skolithos*** *and Rhizocorallium*. Figure 3 illustrates the development stage of *Glossifungites* ichnofacies.

In a thinly bedded sandy siltstone, claystone and silty sandstone lithofacies of a shallow marine shoreface succession, biogenic structures play a significant role by acting as both the hydrocarbon reservoir and conduit (Reksalegora, 1999). In the hydrocarbon interval, this thinly bedded lithofacies commonly gives low to moderate contrast between the shallow and deep resistivity reading, despite having high Gamma Ray reading. Drill Stem Test and production tests have confirmed significant oil rate from this type of lithofacies.

More publications and works are now integrating detailed observations of trace fossils to enhance their understanding of paleodepositional environment, the processes that were active during the deposition, and the reservoir and seal properties. However, one must remember that this method can not stand by itself. It needs integration with other methods such as stratigraphic, sedimentologic and paleontologic analyses. Only with integration can a more rigorous model be developed.

References :

MacEachern, J. A., I. Raychaudhuri and S.G. Pemberton, 1992, Stratigraphic application of the *Glossifungites* ichnofacies: Delineating discontinuities in the rock record, *in*: S. G. Pemberton, 1992, Society of Paleontologist and Mineralogists Special Publication No. 44, p.

Pemberton, S.G., 1995, Trace Fossil School: Ichnological Concepts and Selected Core Studies, Department of

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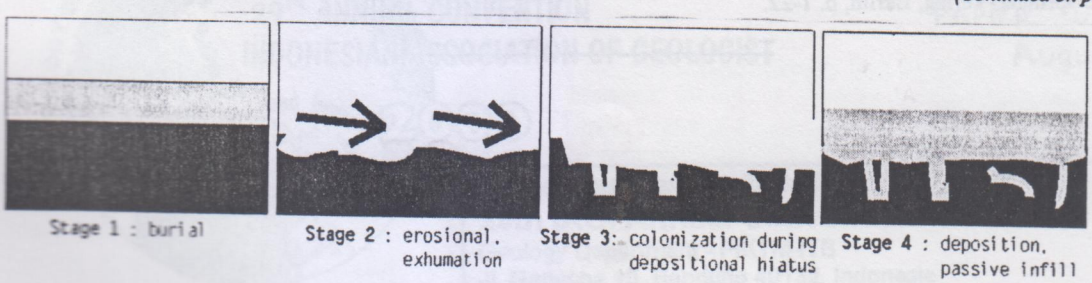


Fig. 3. Schematic development of a Glossifungites ichnofacies. 1) The muddy substrate is burried and dewatered, resulting in a compacted, stiff character. 2) The shaly bed is errosionally exhumed, exposing a firm substrate. 3) Colomzation of the discontinuity surface by trace makers of the Glossifunites ichnofacies procees under marine conditions during a depositional hiatus. 4) The structures are passively filled during a succeeding depositional event. (Pemberton, 1995)

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Geology, University of Alberta, Edmonton, Alberta, Canada.

Reksalegora, Sena W., 1999, Biogenic Structure of B-28 zone "Main" Interval, Offshore Northwest Java, FOSI/ITB/IAGI Proceeding of Regional Seminar on Tectonics and Sedimentation of Indonesia.

(Continued from page 18)

NABASIR, A, ANDRIYANI, S., HENDAR, S.M., HARUJI, M.P., SUBAGIO. 1999. Integrated study of the Telisa shalysand reservoir in The Bangko field, Central Sumatra Basin. *Proceedings of Indonesian Association of Geologists (IAGI), 28th IAGI Annual Convention.*

POSAMENTIER, H.W., & ALLEN, P.A. 1999. Siliciclastic sequence stratigraphy: concepts and applications. *Indonesian Sedimentologists Forum (FOSI).*

ROESTENBURG, J. 1988. Subsurface structural and stratigraphic analysis using in-situ wellbore formation images and core comparisons. *IPA Proceedings, 17th IPA annual Convention*

SALIMULLAH, A.R.M., & STOW, D.A., 1992. Application of FMS images in poorly recovered coring intervals: examples from ODP Leg 129, in Geological applications of wireline logs II. *Geological Society Special Publication No. 65.*

SCHLUMBERGER, 1986. Fundamentals of Dipmeter Interpretation. *Schlumberger Educational Services.*

SELLEY, R.C. 1985. Ancient sedimentary environments. *Chapman and Hall.*

SERRA, O. 1989. Formation microscanner image interpretation. *Schlumberger Educational Services.*

SERRA, O. 1989. Sedimentary environments from wireline logs. *Schlumberger Educational Services.*

SERRA, O., STOWE, I., MOTET, D. 1993. True integrated interpretation. *SPWLA 34th Annual Logging Symposium.*

SOVICH, J.P., & NEWBERRY, B. 1993. Quantitative applications of borehole imaging. *SPWLA 34th Annual Logging Symposium.*

STANDEN, E., NURMI, R., ELWAZEER, F., OZKANLI, M. 1993. Quantitative applications of wellbore images to reservoir analysis. *SPWLA 34th Annual Logging Symposium.*

WATHAN, R.R., HUNTORO, T., HENDROWIBOWO, K., SUMANTRI, H., LLOYD, P.M. 1996. Formation imaging in geothermal wells – A key to improved reservoir characterization in the Kamojang field of West Java. *IPA Proceedings, 25st IPA annual Convention*

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Multi-well analysis shows comparable spectral trends, indicating that periodic climatic changes have an important and dominant control in the time and spatial variability of depositional facies.

Acknowledgement

The author thanks Jan Brouwer from OYO-CAG for fruitful discussions and comments concerning the spectral analysis of wireline logs. NITG-TNO generously gave permission for using the wells in this publication.

References

Einsele, G, W. Ricken and A. Seilacher, 1991, Cycles and events in stratigraphy – basic concepts and terms. In: G. Einsele et al. (eds), Cycles and events in stratigraphy. Springer-Verlag, Berlin, p. 1-22.

Fischer, A.G., 1986, Climatic rhythms recorded in strata. Ann. Rev. Earth Planet. Sci., 14, p. 351-376.

Fischer, A.G. and L.T. Roberts, 1991, Cyclicity in the Green River Formation (lacustrine Eocene) of Wyoming. Journ. Sed. Petr., 61, p. 1146-1154.

House, M.R., 1995, Orbital forcing timescales: an introduction. In: M.R. House and A.S. Gale (eds), Orbital forcing timescales and cylostratigraphy. Geological Society, Special Publication 85, p. 1-18.

Olsen, P.E., 1986, A 40-million year lake record of early Mesozoic orbital climate forcing. Science, 234, p. 842-848.

Perlmutter, M. A. and M. D. Matthews, 1990, Global cyclostratigraphy – a model. In: T.A. Cross (ed), Quantitative dynamic stratigraphy. Prentice-Hall, p. 233-260.

Premoli-Silva, I.and E. Erba, 1988, Field guide of Umbria-Marche area, September 16, 1988. Working group 3 – Cyclostratigraphy, Perugia, Italy.

Schwarzacher, W., 1993, Cyclostratigraphy and the Milankovitch theory. Elsevier, Amsterdam, 225 pp.
