

Unburrowed mudstones may record only slightly lowered oxygen conditions in warm, shallow basins

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Foraminiferal Sample Preparation Methodology

All samples of mudstone were mechanically crushed and dry sieved with a 10 mesh screen (2 mm). One hundred fifty grams of each sample were divided into two beakers and immersed in industrial-grade hydrogen peroxide (~62%) to oxidize organics and facilitate disaggregation of the sample into component grades. Samples were permitted to react up to 4 periods of immersion and then wet sieved with a 230 mesh screen (0.063 mm) collecting the finest fraction with an underlying pan. Residues were allowed to dry and then dry sieved to collect the coarsest fraction with an 80 mesh screen (0.18 mm). The coarsest fraction was picked at this stage to minimize damage to the more delicate multiserial foraminifers during successive processing.

Once picked, the remaining residue was placed into a beaker with commercial bleach and heated to 200°C on a hot plate for 12 hours. Gentle agitation was provided by an overhead propeller blade and motor, as over-processing and breakage of fossils are common using magnetic stirrers. After 12 hours, the residue was wet sieved using a 230 mesh screen and dried. A subset of the finest fraction was collected using a pan.

Once dried, the sample was separated into components using a stacked set of screens (40 mesh (0.425 mm), 80 mesh (0.18 mm) and 100 mesh (0.15 mm) with an underlying pan. All residue of coarser than 100 mesh (fine-grained sand and coarser) was picked using a standard aluminum tray (70 mm x 25 mm). Two trays of residue less than 100 mesh (very fine-grained sand) and one tray of residue from the wet sieve pan (silt) were picked. Fossils were mounted onto a standard cardboard microscope slide prepared with Gum-Tragacanth. Genera and species were identified by Graham Dolby and Associates (MacEachern et al., 1999) and Dr. C.R. Stelck of the University of Alberta (Stelck et al., 2000). The procedure followed is a modification and refinement of the processing techniques used in Koke and Stelck (1985) and Stelck and Koke (1987).

Koke, K.R., and Stelck, C.R., 1985, Foraminifera of a Joli Fou Shale equivalent in the Lower Cretaceous (Albian) Hasler Formation, northeastern British Columbia: Canadian Journal of Earth Sciences, v. 22, p. 1299-1313.

- MacEachern, J. A., Stelck, C. R., and Pemberton, S. G., 1999, Marine and marginal marine mudstone deposition: Paleoenvironmental interpretations based on the integration of ichnology, palynology and foraminiferal paleoecology, *in* Bergman, K. M. and Snedden, J.W., ed., *Isolated Shallow Marine Sand Bodies: Sequence Stratigraphic Analysis and Sedimentologic Interpretation*, Volume Special Publication 64: Tulsa, SEPM Society for Sedimentary Geology, p. 205-225.
- Stelck, C.R., and Koke, K.R., 1987, Foraminiferal zonation of the Viking interval in the Halser Shale (Albian), northeastern British Columbia: *Canadian Journal of Earth Sciences*, v. 24, 2254-2278.
- Stelck, C. R., MacEachern, J. A., and Pemberton, S. G., 2000, A calcareous foraminiferal faunule from the upper Albian Viking Formation of the Giroux Lake and Kaybob North fields, northwestern Alberta: implications for regional biostratigraphic correlation: *Canadian Journal of Earth Sciences*, v. 37, p. 1389-1410.

Supplementary Table Captions

Table DR1 – Benthic foraminiferal taxa recovered from Joli Fou, Viking, and Westgate formation mudstone samples. Sample type divides all samples into either highly bioturbated silty and sandy mudstones or unbioturbated and low BI mudstones. Sample numbers correspond to sample numbers in figures 2 and 3. Unique well identifiers (UWIs) define well locations within western Canada. These data are published in MacEachern et al. (1999) and Stelck et al. (2000).

Table DR2 – Benthic foraminiferal abundance recovered from Joli Fou, Viking, and Westgate formation mudstone samples. Sample type divides all samples into either highly bioturbated silty and sandy mudstones or unbioturbated and low BI mudstones. Sample numbers correspond to sample numbers in figures 2 and 3. Unique well identifiers (UWIs) define well locations within western Canada. These data are published in MacEachern et al. (1999) and Stelck et al. (2000).

Table DR3 – Geochemical attributes included in Figure 3 for mudstone samples from the Joli Fou, Viking, and Westgate formations. Sample type divides all samples into either highly bioturbated silty and sandy mudstones or unbioturbated and low BI mudstones. Sample numbers correspond to sample numbers in figures 2 and 3. Unique well identifiers (UWIs) define well locations within western Canada. Blue columns indicate data where some concentrations were below the detection limit of the analytical equipment, and had to be modified to plot on graphs in Figure 3. In these cases, a value halfway between the detection limit and zero was chosen. (CS = Combustion-Infrared Spectrometry; IR = Infrared Spectrometry; TD ICP = Total Digestion Inductively Coupled Plasma Optical Emission Spectrometry; INAA = Instrumental Neutron Activation Analysis; TD-MS = Total Digestion Mass Spectrometry (Sample preparation and analysis methodologies are available at www.actlabs.com)).