Unconformities and Extinctions bounding the Triassic of Western Canada

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The Triassic is the only system within the Phanerzoic erathem that is bounded on both sides by major extinction events - the P-T and T-J. This makes the Triassic particularly interesting from an evolutionary perspective as it provides an opportunity to study biotic changes between two "episodes of terror". A feature common to both of these extinction events is that they occurred during major eustatic lowstands. The resulting unconformities are of interest to economic geologists because each may provide important hydrocarbon traps. There are numerous unconformities within the Triassic as well, and each of these may contribute to the trapping of hydrocarbon resources; in fact, the Triassic contains about 10% of the Western Canada Sedimentary Basin hydrocarbon total. These various biotic and stratigraphic events can serve to draw our attention to this chaotic and deadly period of time.

The Permian-Triassic boundary interval was considered to be absent in many areas of the world, including Western Canada, because of the unconformity associated with a major lowstand. The Permian-Triassic boundary interval is best recognized in strata of the Tethys Sea, and in particular, Southern China where the boundary will likely be defined. However, recent biostatigraphic studies have indicated that the Permian-Triassic boundary interval is represented in Western Canada within the basal black shales (Sulphur Mountain, Montery, Grayling) previously correlated with only the Triassic. At Opal Creek in Kananaskis Country a conodont fauna dominated by Neogondolella roseankrantzi, N. postbitteri?, and N. subcarinata is replaced by one dominated by Neogondolella carinata and N. planata? at about 1.5 metres above the base of the Sulphur Mountain Formation shales (Phrosos Siltstone Member). This suggests that a lowstand, related essentially to the amalgamation of Pangea, occurred during a protracted Late Permian interval and that the subsequent transgression began during the latest Permian and continued into the Triassic. Furthermore, an anoxic episode, that is consistent with the pyritic black shales: and lack of bioturbation, may have been a contributing factor to the P-T extinction as it occurs prior to the boundary, rather than following as indicated by previous interpretations. The lowstand and anoxia are just two factors that contributed to a chaotic ecologic collapse resulting in the greatest extinction event in Earth's history. The conodonts, which are minimally affected by this extinction, provide valuable indices for high resolution sequence biostratigraphic correlation in this interval. Detailed sequence biostratigraphic correlation of other unconformities within the Triassic may provide new exploration insights.

The Triassic-Jurassic boundary, which witnessed the extinction of conodonts, has not been studied to the same extent in the Western Canada Sedimentary Basin. The boundary interval, like the P-T, is unconformable, the most complete sections are near Williston Lake, and the oldest Jurassic is represented by black anoxic shales of the Nordegg. Are there other similarities?

Sequence Biostratigraphic Framework of the Triassic Grayling, Toad, and Liard formations, Williston Lake, northeastern British Columbia

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The Grayling, Toad, and Liard formations at Williston Lake in northeastern British Columbia comprise a shallowing upwards succession of about twenty parasequences deposited within an overall progradational, mixed siliciclastic-carbonate-evaporite depositional system. Sediments accumulated along a low gradient shoreface-continenta! ramp within an embayed or restricted portion of the northern Panthalassian ocean of Pangea. Triassic deposits in the Western Canada Sedimentary Basin have been primarily mapped and correlated using lithostratigraphic methods, occasionally supported by biostratigraphic data. Current research by a joint University of Alberta-University of Calgary group utilizes various high resolution methods within a sequence stratigraphic framework, including gamma-radiation logging, detailed biostratigraphic sampling for conodonts, collection of macrofossils where present, and total organic carbon values from Rock-Eval/TOC pyrolysis.

The sequence biostratigraphic framework of distal locales such as Ursula Creek are difficult to decipher without the use of both outcrop gamma scans and biostratigraphic data. A phosphate-rich horizon at 71-73 m above the Fantasque Grayling formational contact, characterized by a pronounced gamma-radiation "kick" and sudden increase in TOC (from <1 to about 2.5 wt.%), has produced both ammonoids and biostratigraphically significant Anisian conodonts. This horizon is interpreted as a condensed section, and is believed to be equivalent to the Dog phosphate zone in the subsurface to the east. Another condensed section occurs only 20-35 metres higher in the section and has yielded very high TOC values (up to 5 wt.%). Although not yet firmly established, it is believed that this interval may correlate with much of the Liard Formation at the Brown Hill section, east of Ursula Creek on Williston Lake.

The Brown Hill section is a proximal section dominated by shoreface sandstones, but including well defined offshore flooding zones that readily delineate a series of parasequences. Conodonts are not particularly abundant, but while present they are more common in lower shoreface environments. Upper Ludian conodonts recovered from the Liard Formation (beginning near the formation base at 290 m) include Budorovignathus (Epignatholdellas) ? mungoensis and Paragondolella spp.; these species apparently range through several parasequences. Ammonoids diagnostic of the Upper Ludian sutherlandi Zone were also recovered from the top of parasequence L12 at 475 metres. Metapolygnathus spp. with constricted posterior platform margins and Paragondolella navicula navicula may indicate an early Cretaceous age at the base of parasequence L15 at 496 metres.

Talk - Wednesday June 04 '97

ABSAKORA 1 Triassic of Western North America: Stratigraphic Framework and Sedimentary Events

MacLeod Hall A

Session Chairs: Jim Barclay, Tom Moslow

8:10 Introduction
8:20 G.R. Davies: Tectonic and Palaeogeographic Setting and Stratigraphic Framework of the Triassic of the Western Canada Sedimentary Basin
8:40 A.F. Emby: Global Sequence Boundaries of the Triassic
9:00 C.M. Henderson: Unconformities and Extinctions Bounding the Triassic of Western Canada
9:20 M.J. Orchard, E.T. Tocz; Triassic Biochronology and its Application in Western Canada
9:40 H.K. Paul, R.A. Paul: Sequence Recognition and Distribution of Lower Triassic Marine Strata, Western U.S.A.
10:00 J-P. Zonneveld, S.M. Hubbard, T.F. Moslow: Lithofacies Association and Depositional Environments of the Middle Triassic Dog, Halley and Charlie Lake Formations, Tommy Lakes Field, Western Alberta and British Columbia
10:20 P. Goyan, D. Pruden: The Significance of the West Stoddart Dog Oil Discovery, Northeastern Occurrence of Columbia
11:00 M.D. Wilson: Controls on Reservoir Quality in the Triassic Sag River Sandstone. A Product of Strong Upwelling Conditions, Prudhoe Bay Area, North Slope, Alaska
11:20 Y. L. Lam, M. A. Borto, A. Tahmasbi: Facies, Palaeoenvironments and Successions of the Lower Upper Triassic Elka Formation (Upper Absakora A Sequence), Shalmirzad Area, East Central Alberta Range, Northern Iran

Talk - Thursday June 05 '97

High Resolution Biostratigraphy

Graham Room

Session Chairs: Charles Henderson, John-Paul Zonneveld

8:10 Introduction
8:20 C.E. Brett: Sequence Stratigraphic and Biotic Change in Paleozoic Marine Faunas
8:40 F. Agterberg, F. Gradstein: Biostratigraphic Uncertainty in Stratigraphic Traps
9:00 S. Ritter, J. Bariok: Late Carboniferous - Early Permian Conodont Biostratigraphy: A Progress Report
9:40 C.M. Henderson, J-P Zonneveld: Sequence Biostratigraphic Framework of the Triassic Grayling, Toad, and Liard Formations, Williston Lake, Northeastern British Columbia
10:00 J.H. Craig, C.L. Rediger, T.P. Poulton: Cretaceous Stratigraphic Analysis of the Femie Formation, Alberta, Canada: Correlation with the Western Interior of the United States
10:20 R.A. MacRae: Palynology and Sequence Stratigraphy of the Upper Albian (Cretaceous) of the Central Alberta Basin, Canadian Arctic Islands, N.W.T.
10:40 C.J. Linton: Sequence Biostratigraphy of the Upper Cretaceous Waplap and Bad Heart Formations, Alberta, Canada: Correlation with the Western Interior of the United States
11:00 B.A. Christensen, R.C. Thunell, K.G. Miller: High Resolution Sequence Stratigraphic Analysis on the Pleistocene New Jersey Margin Using Benthic Foraminifera
11:20 J.M. Armentrout: Biostratigraphic Signature of Depositional Sequences: Contrasting Examples from the Gulf of Mexico and Niger Delta, Nigeria-Pleistocene