

Productivity and Environmental Conditions Following the Permian-Triassic Mass Extinction: Lower Triassic Rocks from the Western Canada Sedimentary Basin

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Core:	Avg. %TOC	Avg. %TIC
16-8-86/20W6	4.32	12.60
16-33-84/18W6M	3.32	8.00
B-24-B/94-H-16	4.33	3.85
C 20-H/94-H-16	4.79	3.55
C 74-E/94-H-16	3.96	7.43
C 78-I/94-H-9	3.44	10.60

Following the recovery of primary producers in the early Griesbachian, offshore and basinal facies were dominated by anoxic conditions and high primary productivity, which led to the deposition of organic-rich silty shales, as reflected in TOC values ranging from 5-10% (right). Oxygen was periodically introduced to more shoreward facies by turbidity currents or a fluctuating redoxcline, which reduced the preservation potential of organic matter and led to average TOC values from 2-3% for rocks deposited in these environments. Lower shoreface and shallower environments were stirred by waves, which introduced oxygen and led to the preservation of very little organic matter and provided a refugia for Early Triassic fauna (the “habitable zone” of Beatty et al. 2008).

Primary productivity recovered rapidly from the Permian-Triassic mass extinction, and remained robust during the remainder of the Early Triassic. Enhanced values of Ba, Cu and Zn beginning in the early Griesbachian (earliest Triassic) at 2 previously-analyzed outcrop localities from the WCSB (Opal Creek, AB locality and Cadomin, AB locality) as well as from trace element, %TOC and %TIC data from a Dienerian-Smithian drill core (A8-7-85/18w6) from the Pedigree-Ring Border-Kahntah River area in the north-central WCSB suggest that primary producers recovered quickly and were robust through the remainder of the post-extinction interval. Average %TOC values for Griesbachian-aged rocks from other cores from the Pedigree-Ring Border-Kahntah River area range from 3.32 – 4.79 % (left), and provide further evidence of a quick return to vigorous productivity during the Griesbachian.

Depositional Model for Lower Triassic Rocks of the WCSB

Basinal Facies

Laminated silty shale. Anoxic. Evidence for high primary productivity and good potential for preservation of organic matter (TOC values typically 5-10%).

Turbiditic Sands Facies

Interbedded sandy turbidites and silty shale. Anoxic to suboxic. Moderate potential for preservation of organic matter (TOC values typically 2-3% for sandy units and 5-10% for silts and shales). Rare trace fossils.

Lower Shoreface Facies

Hummocky cross-stratified sandstone. Oxygenated, low potential for preservation of organic matter (TOC values up to 2%). Common trace fossils.

