

Microfacies characterization, geochemistry, and fossil preservation of the Sceltrich beds (Middle Triassic, Monte San Giorgio, Switzerland)  
A multi-domain approach to the paleoenvironmental characterization and identification of depositional history

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The Sceltrich beds belong to the basal part of the Upper Meride Limestone and to the fossiliferous levels of the world-famous Middle Triassic Monte San Giorgio Lagerstätte (UNESCO World Heritage List). This 30-cm-thick unit, is characterized by laminated limestone levels and has so far yielded a rich vertebrate fossil fauna, mainly consisting of articulated fish specimens. The objectives of this thesis are to reconstruct paleoenvironmental conditions, to investigate depositional processes, and to characterize the distribution of OM within this sequence. To achieve this, different analytical methods were applied, including optical and scanning electron microscopy and geochemical investigation. The fossil record of the Sceltrich levels was subjected to a preservation study and data were compared to the distribution of OM. The Sceltrich beds were deposited in a predominantly restricted basin, affected by a progressive sea-level fall, under lower dysoxic to anoxic bottom water conditions. Based on geochemical characterizations, the Sceltrich levels show a prevailing type-II kerogen, relative high TOC content (up to 10.81%), and high HI values (up to 699 mgHC/g TOC), associated with bacterial activity. Restricted conditions promoted stagnation, which in turn enabled microbial activity, which developed EPS (extracellular polymeric substances) – like structures. Framboidal pyrite and depletion in  $\delta^{13}\text{C}_{\text{carb}}$  (-2.42‰ to 0.76‰), reflect the heterotrophic activity of sulphate reducing bacteria. Sea-level fall might also account for low depleted values of  $\delta^{13}\text{C}_{\text{carb}}$ .  $\delta^{13}\text{C}_{\text{org}}$  data (-30.90‰ to -28.94‰) also agree with the regression hypothesis. A 1‰ increase towards less negative values of  $\delta^{13}\text{C}_{\text{org}}$  in the upper part of the section could be related to increased input of terrestrial OM. Structures attributed to storm waves, which perturbed lamination, suggest a decrease in basin dimension at the top of the section. Higher content of clay minerals is apparent towards the top, which suggests an increased terrigenous influence. Seawater temperature was calculated by means of  $\delta^{18}\text{O}_{\text{carb}}$  values (-7.41‰ to -3.44‰), which, however, show partial reset by diagenetic water. An overall increasing trend towards less negative values is however visible, which may be linked to a slight and progressive increase in salinity. The  $\delta^{18}\text{O}_{\text{p}}$  from teeth dentin, enamel, and scales of fossil fishes (12‰ to 18.8‰), mostly shows low values and diagenetic alteration. A better preservation is documented for tooth enamel and ganoin-rich scales. Trophic levels of fossil fishes are suggested, based on carbon isotope composition of carbonate within the apatite structure ( $\delta^{13}\text{C}_{\text{c}}$ ). No strong correlation between the presence of microbial activity and the articulation percentage was observed.

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