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Is it possible to distinguish grain size effects, provenance, weathering intensity, and post-depositional processes in lacustrine sediments? Example from early Miocene Most Basin, Czech Republic

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The geochemical composition of (mainly) siliciclastic sediments is a result of all factors listed in the title of this abstract. Most researchers using geochemical composition of sediments to address any of those factors tend to neglect the other ones or use simplified assumptions instead of dealing their tricky interplay empirically or at least in a state-of-the-art manner. There are abundant examples of such approach in published research papers, of which examples will be shown. The reason for simplifications might be pragmatic: deciphering real complexity is perhaps too demanding (or not enough exciting) for the current system of research work and funding.

We have studied fine (silty-clayey, fossil-barren) siliciclastic sediments in a sedimentary basin of the early Miocene age. In our search for a climatic signal in the sediment composition we identified three most promising candidates: (1) relative concentration of potassium (the main geochemically soluble element) as a proxy for chemical weathering intensity, (2) Al/Si and Zr/Rb concentration ratios as proxies for sediment grain size, and (3) concentration of siderite (Fe,Mg,Ca,Mn)CO_3 (the main chemogenic component in the sediment). All those element parameters turned to be interrelated in some manner that prompted for their integrated evaluation. The main problem of consolidated sediments (in our case with at least 5 % siderite in a form of small crystals and compaction by resting below several hundred meters of sediment for about 10 My) is impossibility of experimental evaluation of grain size effects using granulometry or sieving or settling separation. We thus used state-of-the-art knowledge on the fine sediment geochemistry.

Our literature survey yielded a very limited number of studies aimed at deciphering the factors listed in the title and conducted with sediments where provenance is known and grain-size effects experimentally studied. Even perhaps more surprising is that some of the crucial studies have been published in recent years, which clearly document a gap in the knowledge, which needs to be filled.