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Defining organic matter quality in sediment systems: a suggested classification scheme

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The quantity and quality of the mineral component of sediments is a core focus of sedimentological investigation in terrestrial systems. This is not to say that the organic component of collected sediments is simply ignored; the organic component is often scrutinised, but in some fields in a restricted manner, limited to basic characteristics such as the ratio of organic to mineral content derived from loss on ignition. There is no doubt that this information is useful; however, these types of analysis indicate the quantity of organic matter relative to a particular temporal scale or volume, rather than treating the organic fraction as a separate entity worthy of substantial investigation. The quality of the organic component is being increasingly considered in a number of fields, with molecular, thermal, spectroscopic and bulk methods being used. However, models and theories on organic matter processing in a variety of environmental systems, have been developed without clearly defining organic matter quality, because most results do not depend on an outright measure of quality (Bosatta and Agren, 1999). With approaches and techniques varying between fields, there is a need to consider a more systematic approach to the analysis and definition of organic matter quality.

The disparities in the definition of the quality of organic matter, and thus how it may be measured have vital implications for the study of carbon cycling, biogeochemical processing, and ultimately ecosystem structure and function. The quality and quantity of organic matter have an influence on the chemistry and biology of systems and may reveal a wealth of past or contemporary environmental information.

In this paper we provide a classification of organic matter quality and examples of potential applications and suitable techniques for the analysis of the main classes of organic matter character. A more consistent approach to organic matter characterisation has the potential to aid understanding of soils and sediments through consideration of decomposition dynamics; accounting for organic matter variety in carbon cycling and budgeting; use of organic proxies of source determination; and investigations into palaeovegetation and palaeoclimate.