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The vertical and lateral heterogeneities in paleoenvironment and organic matter abundance of the Early Cambrian Qiongzhusi Formation black shales in the Sichuan Basin, SW China: constraints from geochemical evidence

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We present trace elements, total organic carbon (TOC), and organic carbon isotope studies on fresh cores of two Early Cambrian wells from the central (Well W201) and southern (Well N206) Sichuan Basin, and compare them with previous findings from the Yangtze Block. The lower part of the Qiongzhusi Formation shows high TOC abundance, while the middle and upper parts display relative low TOC content. We subdivided the Qiongzhusi Formation into high-TOC layers and low-TOC layers. Redox-sensitive elements (Mo) and trace elemental redox indices (Ni/Co, V/Cr, U/Th and V/(V+Ni)) suggest that the high-TOC layers were deposited under anoxic/euxinic conditions, while the low-TOC layers under relatively dysoxic/oxic conditions. The Mo-TOC relationships reveal that the Qiongzhusi Formation black shales were probably deposited under moderately restricted conditions. The relationships of enrichment factors of Mo and U show a transition from suboxic low-TOC layers to euxinic high-TOC layers. Organic carbon isotope results present temporal variations for the Qiongzhusi Formation, with a positiveδ13Corgvalueshift in the lower part and a continuous positive excursion of δ13Corgvalue in the middle and upper parts. These variations likely reflect changes of organic carbon burial with respected to the different depositional environment. The correlation of organic carbon isotopic data for the Early Cambrian black shales in different regions of the Yangtze Block shows lateral homogeneity with an important δ13Corg values positive shift in the lower part for each section. These similarities can be ascribed to the same depositional environment caused by widespread Early Cambrian transgression in the Yangtze Block, followed by subsequent black shale deposition.