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Widespread euxinia during the late Ediacaran ocean oxygenation event (Shuram) in South China

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The largest negative $\delta^{13}C_{carb}$ excursion in Earth history, the Shuram/Wonoka event, occurred towards the end of the Ediacaran Period. In China, the DOUNCE excursion can now be correlated with the Shuram anomaly and appears to have lasted about ten million years, beginning around ca. 570 Ma within Doushantuo Formation Member III, but extending through Doushantuo IV (the 'Miaohe' black shale). Previous studies suggested that anoxic ferruginous conditions in the deep marine environment gave way to more oxic conditions after the c.580 Ma Gaskiers glaciation in Newfoundland. However, over the South China Craton, the ocean seems to have been strongly redox-stratified, with some authors proposing an oxic surface layer resting above a sulfidic wedge that was sandwiched within ferruginous deep waters. Because the Doushantuo Fm can be traced widely across the craton and in evidently different depth settings, South China offers a good opportunity to study the redox structure of the productive margins of an Ediacaran ocean (Nanhua basin) during the DOUNCE excursion, which has been interpreted to indicate ocean oxygenation. A range of redox-sensitive elemental (e.g. Mo) and isotope (e.g. Mo, U, S) data from Doushantuo IV have been used to support this global oxygenation event. Fe speciation studies can shed light on the redox state of the paleo-ocean but have only been applied to a limited range of sections during this time interval. This study reports new Fe speciation and redox-sensitive isotopic data from the upper Doushantuo Fm. at seven different sections, ranging from shelf to slope settings throughout the Nanhua basin, and offers an attempted spatial reconstruction of the redox state of the Ediacaran ocean. Our reconstruction confirms that pyrite deposition beneath euxinic waters was widespread along productive margins during the latter stages of the Shuram/DOUNCE anomaly, and supports the idea that pyrite burial contributed to oxygenation during the late Ediacaran.