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How wet was the English Wealden? Insights into Early Cretaceous continental climates and environments from sphaerosiderite geochemistry

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Sphaerosiderites are mm-sized spherules of iron carbonate that form in reduced wetland soils. It has previously been argued that the oxygen-isotopic composition of Cretaceous sphaerosiderites can be used to reconstruct ground-water δ^{18}O and, thus, palaeohydrology and palaeoclimates. However, to date, this work has focused almost exclusively on the mid-Cretaceous of North America. We present initial petrographic, elemental and stable-isotopic (δ^{13}C, δ^{18}O) data from sphaerosiderites collected from the Lower Cretaceous (Berriasian) Wealden sediments of southern England. The elemental data demonstrate that the Wealden sphaerosiderites are composed of very pure $FeCO_3$, with only small amounts of Ca, Mg and Mn present. These data suggest that the sphaerosiderites of the Wealden are well preserved and formed in fresh-water dominated soils. The sphaerosiderite stable-isotope data for multiple samples from each soil show relatively invariant δ^{18}O values, with typical standard deviations less than 0.75 per mil. Average δ^{18}O values for each soil are in the range of $\sim$-4.5 to -2 per mil. Average δ^{13}C values have a much larger range than δ^{18}O values, spanning from $\sim$-5 to -30 per mil. Furthermore, each soil has a large standard deviation in δ^{13}C values, typically greater than 3 per mil. The relationship between carbon and oxygen suggests that Meteoric Sphaerosiderite Lines are preserved, allowing us to calculate the δ^{18}O of groundwater and precipitation. We discuss the implications of these results for understanding climate during the deposition of the Wealden. Furthermore, through comparison with the North American data, we are able to place our data into the wider geographic and temporal context thereby providing new insights into Creta-

ceous terrestrial palaeohydrology.