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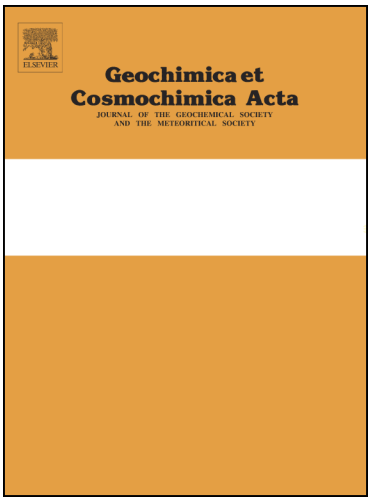

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PII: S0016-7037(18)30503-9
DOI: https://doi.org/10.1016/j.gca.2018.08.048
Reference: GCA 10921

To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 30 March 2018
Accepted Date: 30 August 2018

Please cite this article as: Shawar, L., Halevy, I., Said-Ahmad, W., Feinstein, S., Boyko, V., Kamyshny, A., Amrani, A., Dynamics of pyrite formation and organic matter sulfurization in organic-rich carbonate sediments, *Geochimica et Cosmochimica Acta* (2018), doi: https://doi.org/10.1016/j.gca.2018.08.048

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Dynamics of pyrite formation and organic matter sulfurization in organic-rich carbonate sediments

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Abstract

Organic-rich carbonate sediments are deposited in a range of environments today and in the geologic past. A significant part of organic matter (OM) degradation in such sediments often occurs by microbial reduction of seawater sulfate, and the sulfide product may be preserved in pyrite and in organic sulfur (S) compounds. The isotopic composition ($\delta^{34}S$) of these phases can provide valuable information about S cycling in the ocean and in sediment porewaters, but only insofar as the processes governing these $\delta^{34}S$ values are understood. To this end, we investigated the pathways, timing and interactions between pyrite and organic S formation during the deposition of organic-rich chalks. As a test case, we studied cores representing the thickest (~350 m) and most complete Late Cretaceous organic-rich sequence along the southern Paleotethyan margin. The organic S and OM contents show an inverse relation with the pyritic S content, which together with the uniform Fe_{Py}/Fe_{HR} ratio (~40%), suggest competition between organic S and pyrite formation. Both kerogen and pyritic S are ^{34}S-depleted relative to Late Cretaceous marine sulfate ($\delta^{34}S$~17-20‰), but the kerogen S is

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