



## Geochemical Self-Organization

Peter J. Ortoleva

**Series :** [Oxford Monographs on Geology and Geophysics, 23](#)

This monograph offers an interdisciplinary approach to the analysis of geological systems which become spatially organized through the mediation of chemical processes. The treatment is based on a mathematical approach. The intended readership includes researchers and advanced undergraduate and graduate students in all branches of geology as well as scientists and mathematicians concerned with nonlinear dynamics, numerical analysis, self-organization, nonlinear waves and dynamics, and phase transition phenomena. The work could also serve as a basis for a special topics course in mathematics, chemistry or physics.

**Readership :** Advanced undergraduates and graduate students and researchers in geology

### Reviews

- "This book provides an exciting approach to the understanding of many geochemical phenomena, in that it challenges many commonly held beliefs concerning our knowledge and application of equilibrium thermodynamics in geochemical processes ... The book is not written in an intimidatory or dismissive style ... [the author] presents conventional concepts at the start of each chapter, followed by his concepts or subtly presents alternative models without being entirely dismissive of the conventional ones." -- *Pure and Applied Geophysics*
- "Chaos is one form of non-linear behaviour that is beginning to make its presence felt in the geological literature. However, this book is about self-organization--non-linear behaviour that may be just as disturbing to traditional views about how geological objects acquire their shapes and compositions .... This is an interesting and unconventional contribution. Sections could be read with profit particularly by sedimentologists, structural geologists, metamorphic petrologists and geochemists of all stamps. I would recommend that a copy reside in your institutional library." --*Journal of Petrology*
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1. Introduction
2. Feedback, Instability, and Bifurcation
3. Oscillatory Zoning in Crystals
4. Reaction-Transport Modeling
5. Flow-Driven Reaction Fronts
6. Dissipative Structures at Reaction Fronts
7. Reaction-Front Morphology
8. Liesegang Banding
9. Unstable Coarsening Fronts and Precipitate Patterning
10. Mechanochemical Coupling
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12. Diagenetic Differentiated Mechanochemical Structures
13. Geodes, Concretions, Agates, and Orbicules
14. Reaction-Driven Advection
15. Compartmentation of a Sedimentary Basin
16. Oscillatory Fluid Flow through the Fracturing and Healing Cycle



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Peter J. Ortoleva is at Indiana University.

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Geochemical Self-Organization. Peter J. Ortoleva. Series : Oxford Monographs on Geology and Geophysics, 23. However, this book is about self-organization--non-linear behaviour that may be just as disturbing to traditional views about how geological objects acquire their shapes and compositions . This is an interesting and unconventional contribution. Sections could be read with profit particularly by sedimentologists, structural geologists, metamorphic petrologists and geochemists of all stamps. geochemical and mineralogical environments (127, 128). Download high-res image. Open in new tab. Self-organization of target and spiral patterns is a robust phenomenon that occurs in multiple precipitation systems including zinc hydroxide and mercuric iodide (172). The latter example is particularly interesting because it adds an additional level of complexity because of the polymorph transitions between different HgI<sub>2</sub> crystal structures.