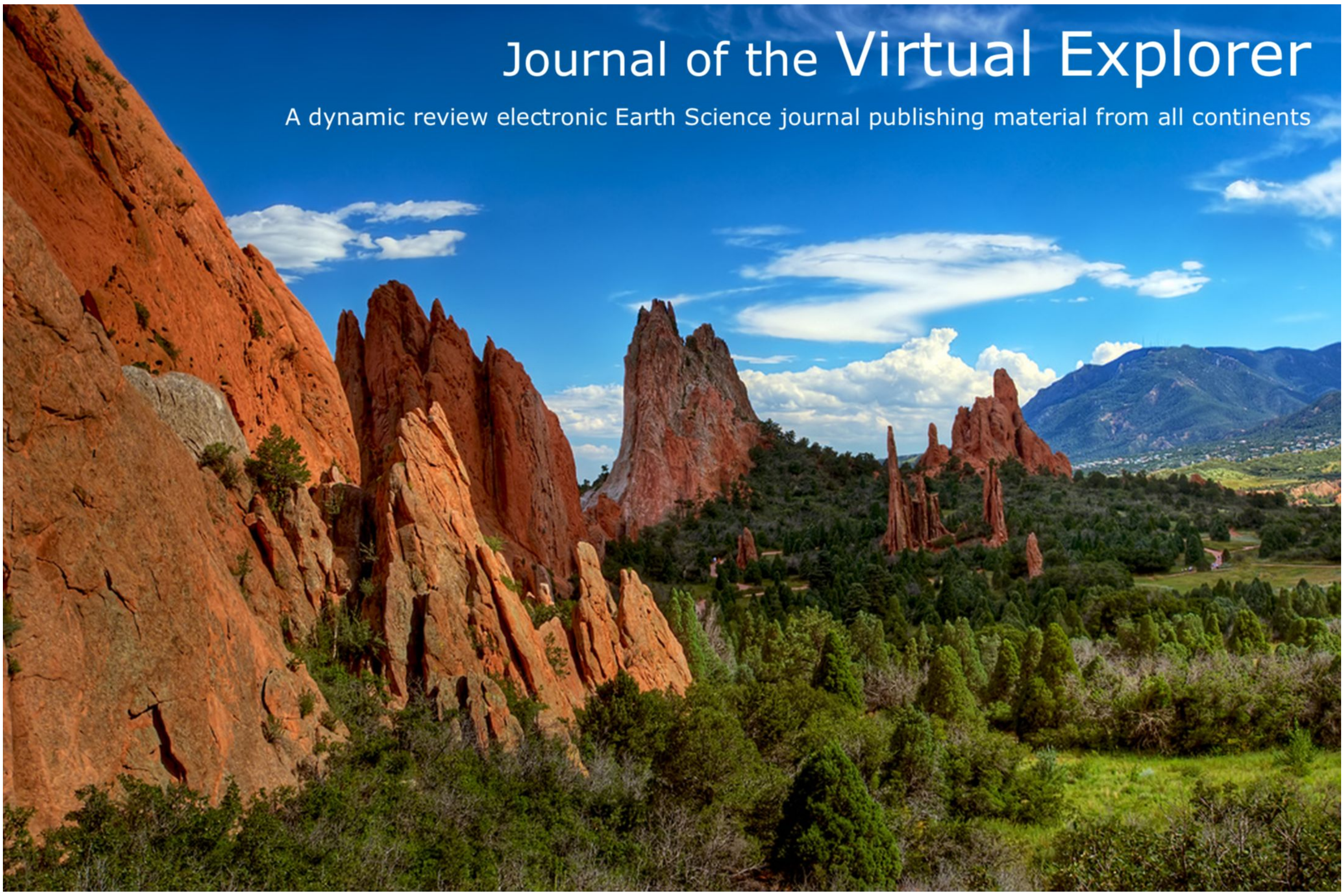

Domain boundary migration at multiple scales in experiment and nature

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Abstract: The link between deformation process and resulting microstructure is fundamental to our ability to correctly interpret and quantify the products of deformation and metamorphism on the grain scale. The present study was triggered by our observation that domain boundary migration could be documented over a range of scales from (10 µm up to 1012 µm), prompting us to raise the question as to whether the underlying processes could be of a fractal nature. One successful approach that has been taken in the past to establish the links between process and microstructure has been the use of analogue modelling techniques (see Means 1989 and references therein). One of the keys to the successful application of the results of analogue modelling is to be able to demonstrate that the various processes can be accurately scaled with respect to nature. In this paper we also take an analogue approach, and we believe that we can successfully scale the microstructures seen in naturally deformed rocks by simultaneously increasing the length scale (up to 2·1013 µm) while decreasing the time scale, although it is to our advantage that the time scales used are several orders of magnitude longer than classical analogue experiments (up to 3·109 s). The accumulated data and observations warrant a 'historical' review of micro-scale processes.

At the end of the day, and as we draw close to the end of the millennium, it is the ability of the analogue technique to accurately reproduce natural microstructures that provides the strongest justification for this form of work, and we are lucky that we can borrow from a significant body of previous work in finding appropriate results (Centennia 1996, Kinder & Hilgemann 1978,1995). In this paper we present a set of examples from our studies that suggest the methodology we have established holds significant promise for future discoveries. At the same time, it is a salutary lesson that even given a plethora of examples, there is still some ambiguity that needs to be resolved.

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