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Evolution of magnetic domain structures from Pseudo-Single-Domain to Multidomain.

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Palaeomagnetic observations over the last 60 years have made a significant contribution to our understanding of the geological structure of the Earth. The interpretation of these recordings is almost entirely based on the assumption that the remanence is held in uniformly magnetised (single-domain) particles. However it has long been recognised that the upper limit for SD magnetite is at about 80nm (for equidimensional grains of magnetite) and it is likely that many palaeomagnetic samples will contain a much broader range of grain sizes, which may be dominated by non-uniformly magnetised pseudo-single-domain (PSD) grains.

Recent progress in determining energy barriers between the different possible domain states in a grain (to be discussed in this session by Nagy et al.) shows that the thermal stability of PSD grains are dominated by energy barriers and domain transitions whose characteristics are SD-like. The magnetic structures in PSD grains undergo a form of domain rotation rather than the domain wall motions observed in multidomain (MD) grains. Thus transition in stability and fidelity of palaeomagentic recorders from the more reliable PSD to less reliable MD structures can be mapped to the evolution of domain walls from the vortex cores of PSD grains.

In this talk we will discuss our preliminary results for very large scale micromagnetic models using a new parallel numerical model called DUNLOP. We will outline the magnetic properties and structures of what we classify as PSD grains and how these types of domains evolve from vortex-dominated to MD structures for easy-axis aligned domains. Such domains are separated by narrow Bloch and Néel - type walls and we discuss the likely impact on the classification of reliable palaeomagentic domain structures.