Fundamental magnetic parameters for greigite, including saturation magnetization, anisotropy constant and exchange constant, were undetermined until recently. Recent experimental determination of these parameters has enabled micromagnetic modelling to calculate domain structures and hysteresis properties of greigite for the first time. A finite element/boundary element micromagnetic model was used to simulate greigite crystals with a range of shapes. Our simulations indicate domain structure evolution from uniform single domain (SD), flowering SD, to vortex and complex multi-domain (MD) structures across a large grain size spectrum. The degree of flowering in SD greigite is not as significant as in magnetite. Our model also predicts nucleation of classical Kittel-like domain structures in greigite with closure domains separated by distinct Néel domain walls. This is probably because greigite has a positive magnetocrystalline constant. Observation of domain structure evolution as a function of grain size also enables determination of critical SD threshold sizes. Our calculations indicate that the superparamagnetic (SP)/SD and SD/MD threshold sizes for greigite cubes are ~20 nm and ~200 nm, respectively. For more realistic geometries, such as cubo-octahedra, the SD/MD threshold size increases up to ~500 nm. Most greigite grains observed from sediments fall within this broader SD size range, which supports experimental observations that much sedimentary greigite has SD behaviour. Modelling of hysteresis loops and backfield demagnetization curves enables construction of a theoretical grain size dependent magnetic property framework for greigite. Variations of hysteresis parameters with grain size, including Day plot parameters, are largely consistent with published experimental data.