**SI CT-scanning**

Segmentation between shell and porosity was done based on the difference in density between pores filled with air (Araldite resin did not penetrate into the internal pores), Araldite resin and carbonate. Porosity was calculated (in Matlab, repetitive 2D approach) by taking the slice per slice ratio of pore pixels to pore + shell pixels (pore volume/(pore volume + shell volume)). The porograph shows the evolution of porosity from the bottom to the top slice in a given image stack. The slice per slice calculation allows to evaluate the evolution of porosity through the shell. The total shell porosity is then obtained by taking the average porosity of all values that were obtained in the slice per slice procedure. The calculated total shell porosity was confirmed by a voxel based volume approach (in Avizo fire, in 3D) that takes into account the total volume of pore and shell voxels.