Applications of FIB coupled with SEM and TEM in geological materials

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In the last few years, we have been applying FIB techniques in parallel to TEM and SEM analyses to obtain information from the µm to the nm-scale in geological materials. In addition to the now well-known methods of TEM foil preparation, we have been using FIB techniques mainly for nanotomography and micromachining of materials. The nanotomography, conducted via FIB-SEM, has been applied in a number of studies, such as (i) 3D reconstruction of open grain and phase boundaries in rocks; (ii) 3D phase quantification and distribution of microstructures, such as symplectites, characterized by the complex intergrowth of two or more phases; (iii) 3D modeling of porosity and organic matter distribution in shales, a very fine grained rock that may potentially store oil and gas. Micromachining on the other hand has been used for the preparation of µm samples of single and polycrystals for ultrahigh pressure experiments in diamond anvil cells, and to cut mechanically anisotropic crystals that are not possible to cut and polish by standard methods.