DETERMINATION OF SILICA POLYMORPHS IN EUCRITES BY CATHODOLUMINESCENCE. H. Chennaoui Aoudjehane[1-2], A. Jambon[2], [1]Université Hassan II Aïn Chock, Faculté des Sciences, Equipe Géoressources, BP 5366 Maârif Casablanca Morocco (e-mail: chennaoui_h@yahoo.fr), [2]Université Pierre et Marie Curie-Paris6 Laboratoire MAGIE, Case 110, 4 place Jussieu, 75252 Paris France (e-mail: jambon@ccr.jussieu.fr)

The physical state of silica is a very useful index of shock in meteorites [1]. We used cathodoluminescence (CL) imaging and spectroscopy to determine its crystalline state in eucrites. CL is a powerful technique which enables easy identification of tridymite, cristobalite, quartz, stishovite, seifertite and high/low pressure silica glass [1, 2, 3] in meteorites and terrestrial rocks.

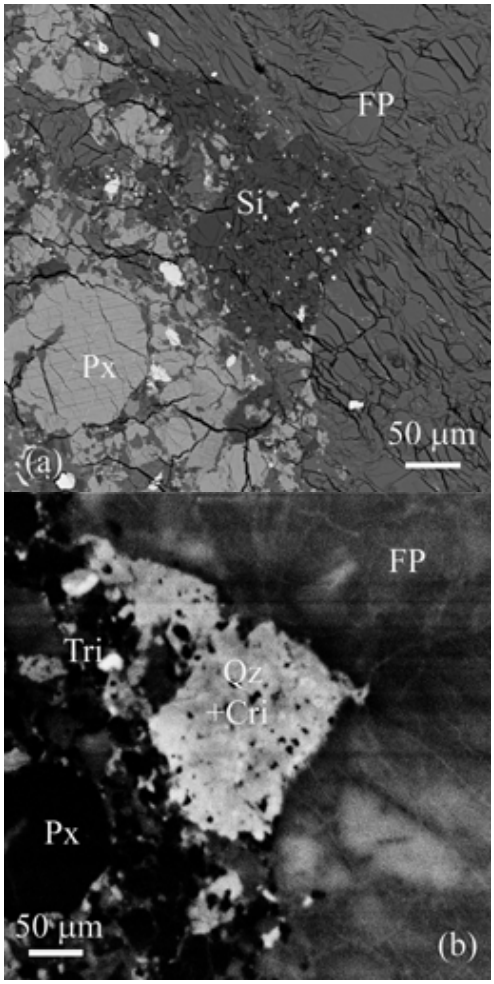


Figure 1: BSE (a) and CL (b) images of a grain of silica (Si) in Camel Donga surrounded by feldspar (FP) and pyroxene (Px). All minerals are strongly fractured. The CL image shows the high luminescence of tridymite (Tri) and the coexistence of quartz (Qz) and cristobalite (Cri) in the same grain. Quartz is more luminescent than cristobalite.

In eucrites, silica is common. Quartz and tridymite have been described. In this work, we have identified quartz, tridymite and cristobalite.

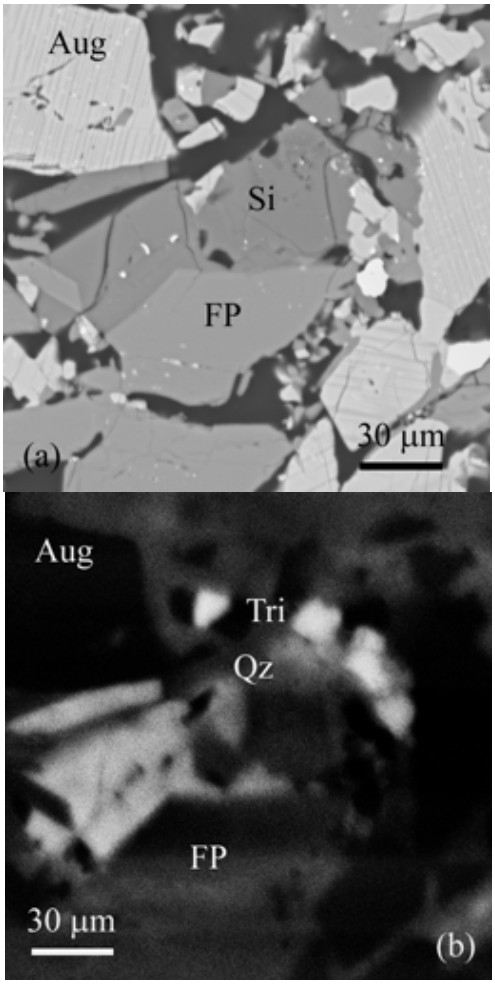


Figure 2: BSE (a) and CL (b) images of a grain of silica (Si) in Juvinas surrounding by feldspar (FP) and augite (Aug). The CL image shows quartz (Qz) less luminescent and tridymite (Tri) with higher luminescence.

All CL measurements have been done with the SEM of the University Pierre et Marie Curie Paris 6. The analytical system is described in [1]. The samples studied are: Camel Donga, Juvinas and Ti Hedjirine (Sah 02501). In each meteorite, we found at least two silica polymorphs, witch could coexist in the same grain (Fig 1, 2, 3).

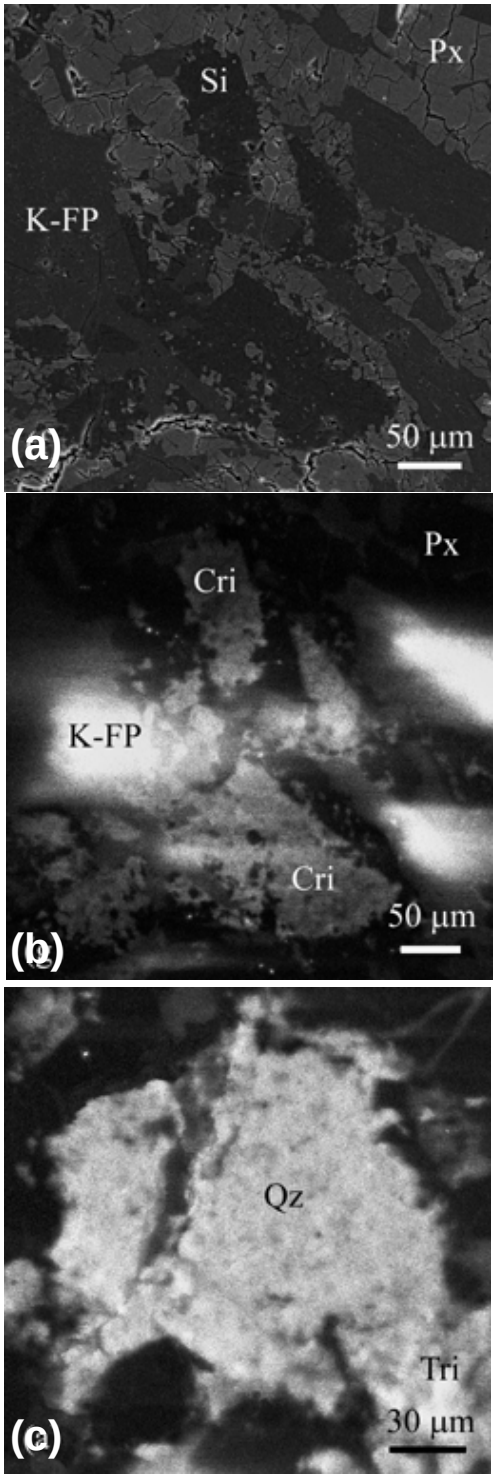
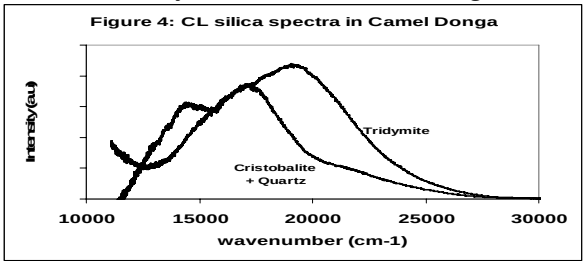
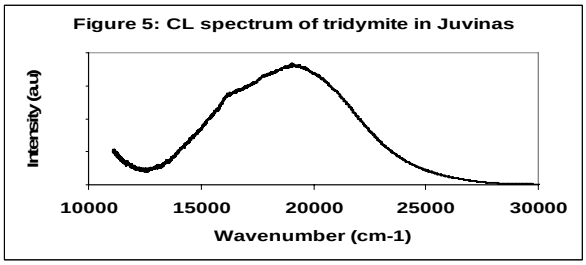


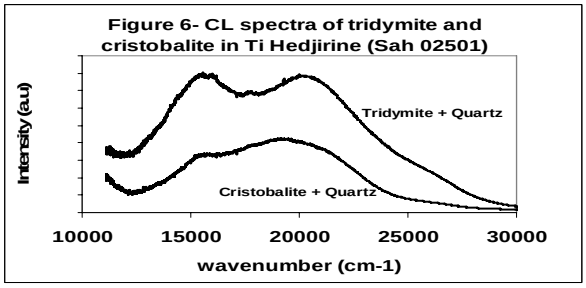
Figure 3: BSE (a) and CL (b,c) images of a grains of silica (Si) in Ti Hedjirine (Sah 02501). The K-feldspar (K-FP) is strongly luminescent, far more than silica [3]. In CL images (b,c) the quartz, cristobalite and tridymite are easily recognized. The luminescence is progressively higher from cristobalite to quarz to tridymite.

The collected CL spectra are typical of these polymorphs [1] (Fig 4, 5, 6). Images of pure silica grains in these eucrites are shown below; according to BSE images they seem homogenous (Fig 1a, 2a, 3a). In CL images however (Fig 1b, 2b, 3b, 3c), the silica heterogeneity is clearly apparent. This heterogeneity is confirmed by the registered CL spectra (Fig 4, 6). This heterogeneity does not show up by any other detection method.

The presence of tridymite, cristobalite and quartz in eucrite confirm that the shock intensity of these meteorites is low, less than 0,1 GPa. The heterogeneity of the silica grains is difficult to explain, the transformation by the shock could be heterogeneous.







Conclusions : CL appears an easy and powerful technique for identifying silica polymorphs in meteorites. Unlike Raman spectroscopy it remains harmless to the samples. It is far more practicable than X-ray or electron diffraction. The presence of tridymite, cristobalite and quartz in eucrites investigated so far is a strong argument to suggest a low shock intensity of less than 0,1 GPa.

References: [1] Chennaoui Aoudjehane H. et al. (2005) MAPS **40**, 967-979. [2] Chennaoui Aoudjehane H. et al. (2006a) LPSC. **XXXVII**, #1036, [3] Chennaoui Aoudjehane H. et al. (2006b) LPSC. **XXXVII**, #1037.