Stardust Al-Foil C2114N1,1
FIB – TEM work

FIB Dual Beam FEI Strata DB 235
TEM FEI Tecnai G2 20 and Philip CM30
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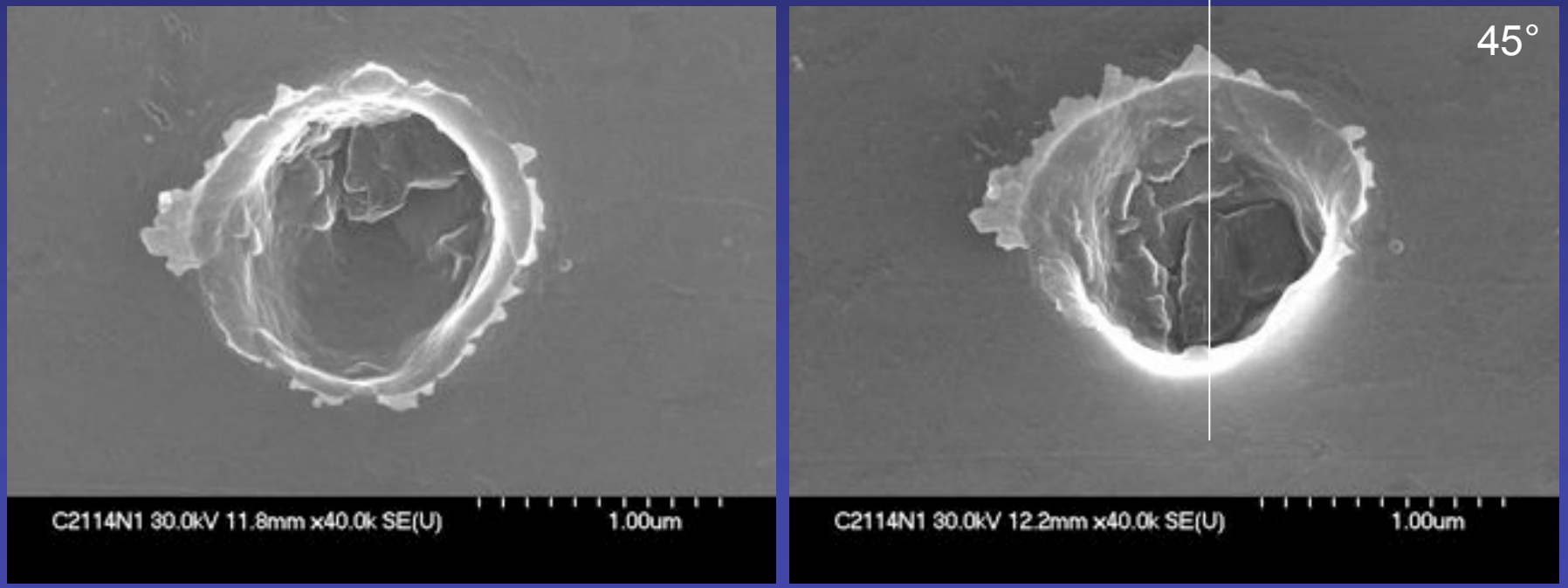
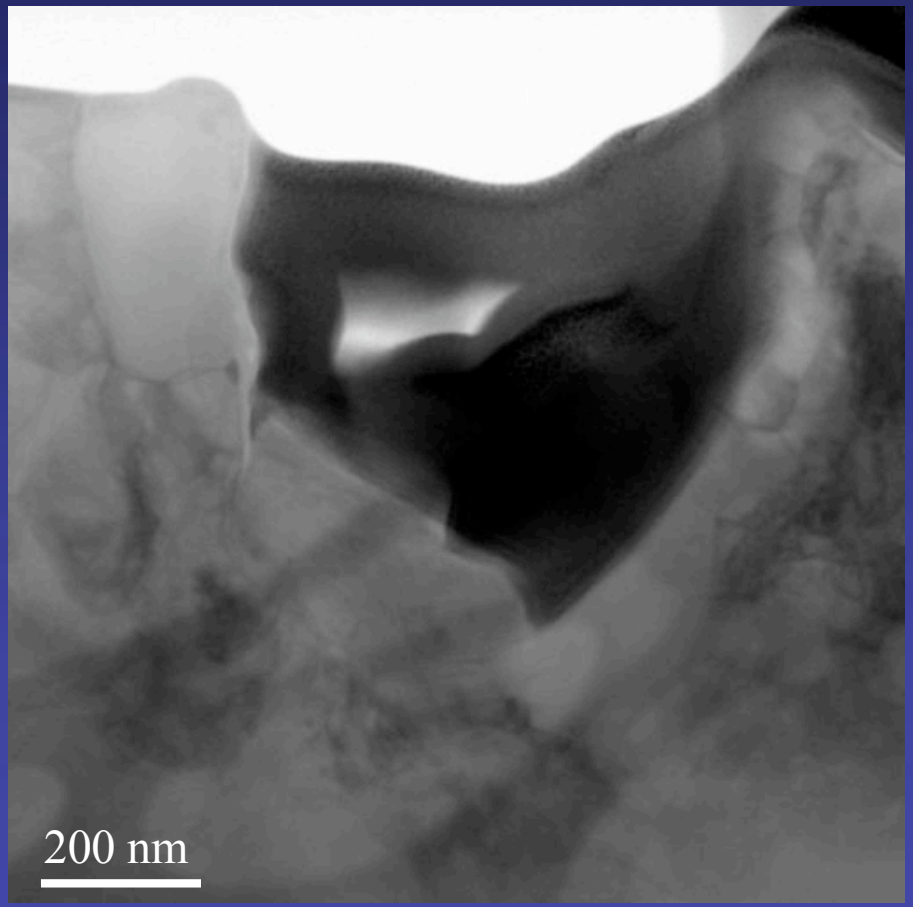
report sent 19 June 2006

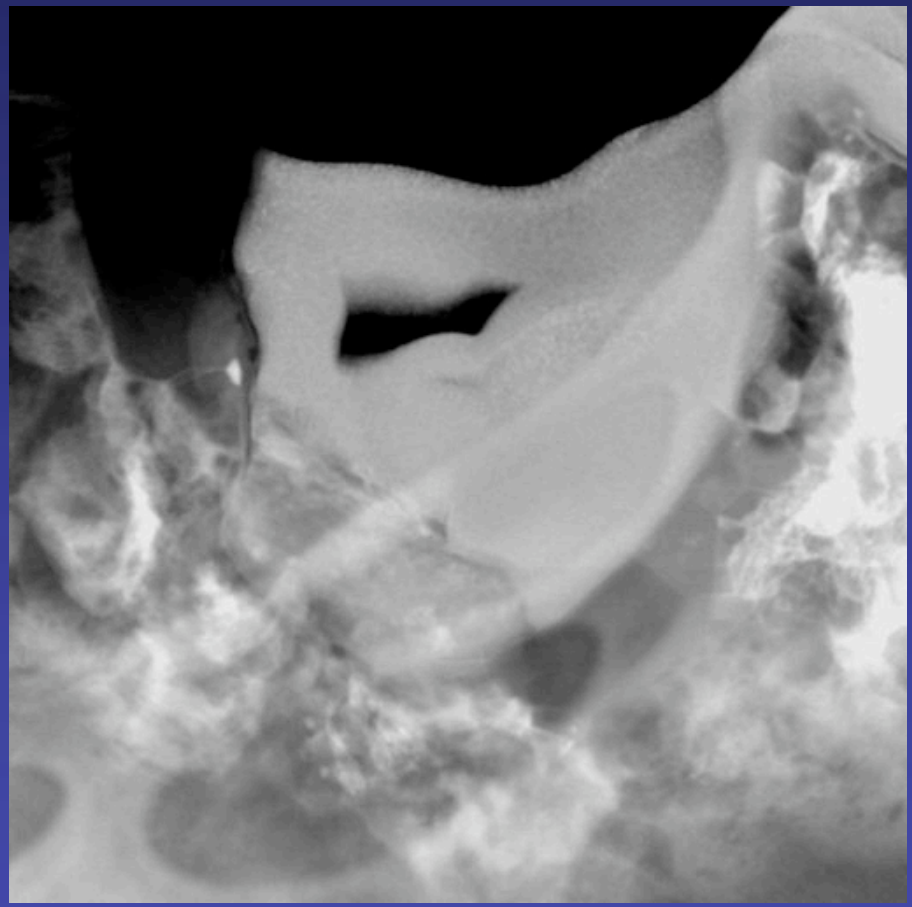
Direction of FIB extraction



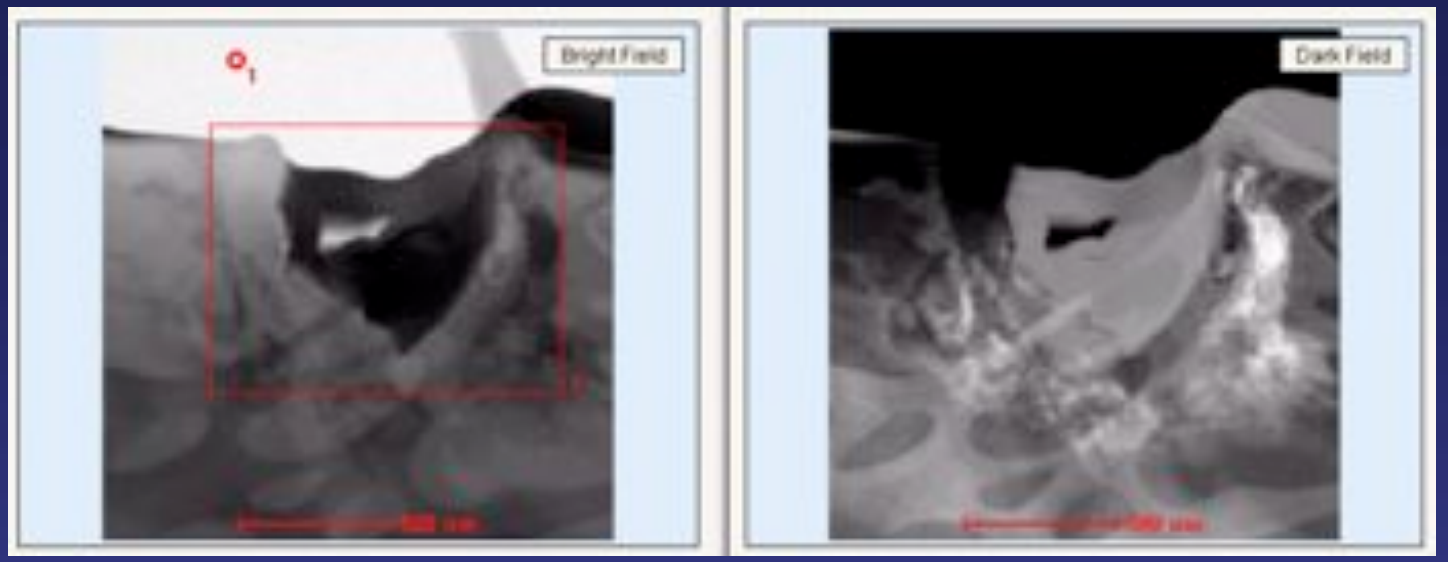
Selected crater before FIB (n°1). We detected O, Si and Mg in the crater by EDS on the SEM

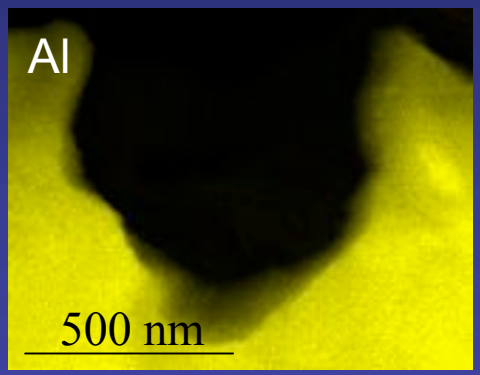
STEM bright field and dark field

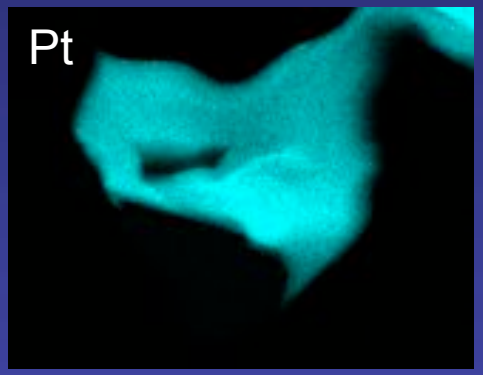


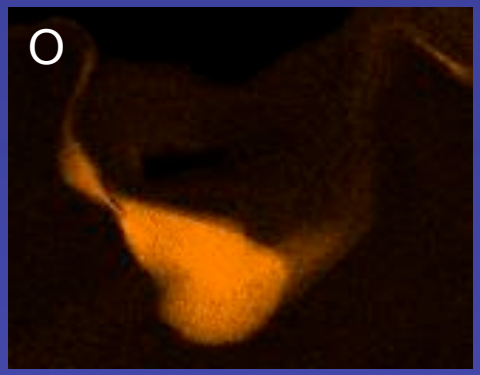


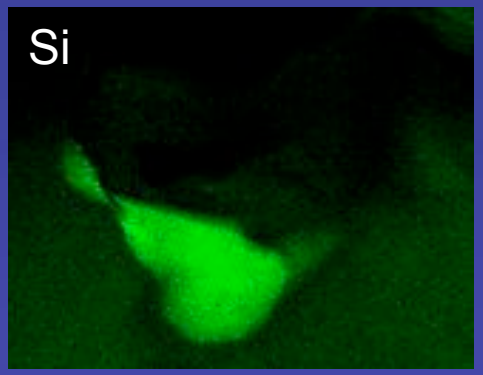
EDS mapping

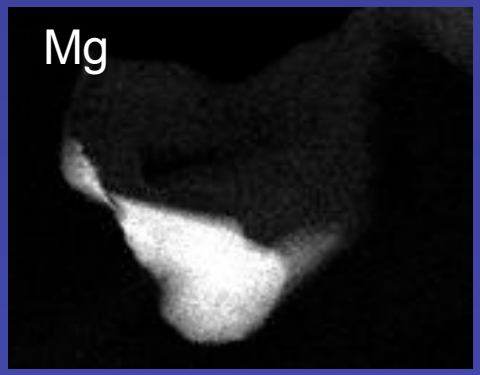




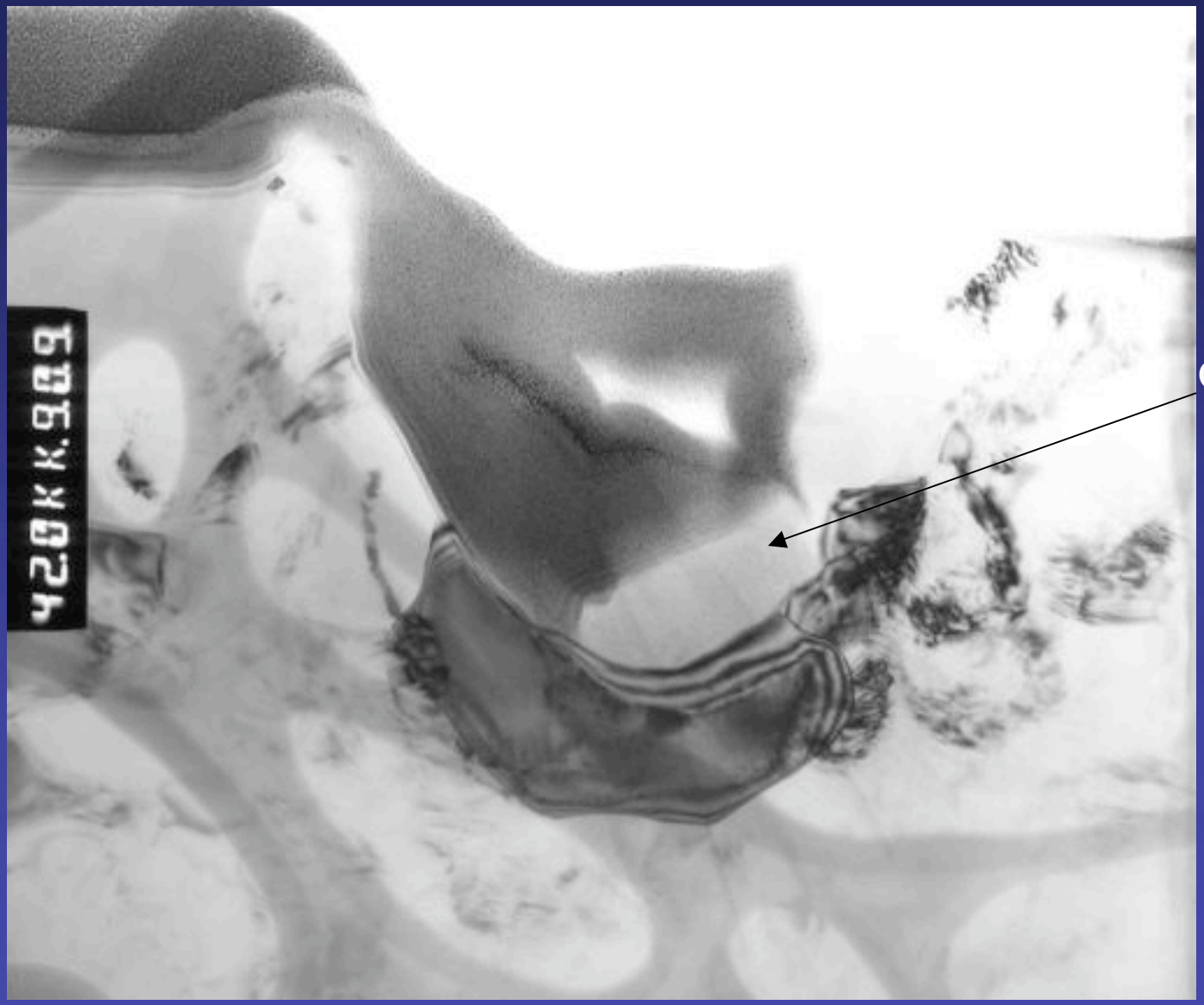






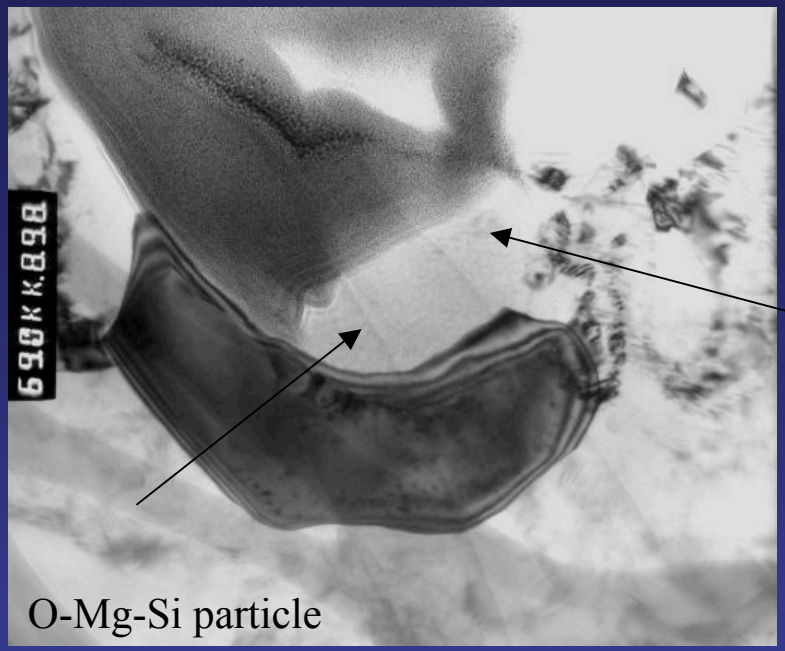


Later, on the CM30

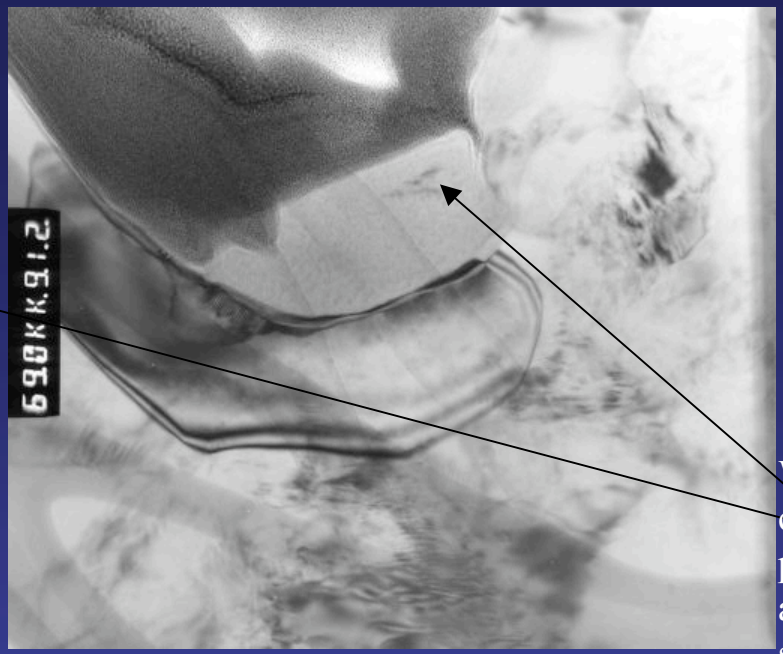


O-Mg-Si particle

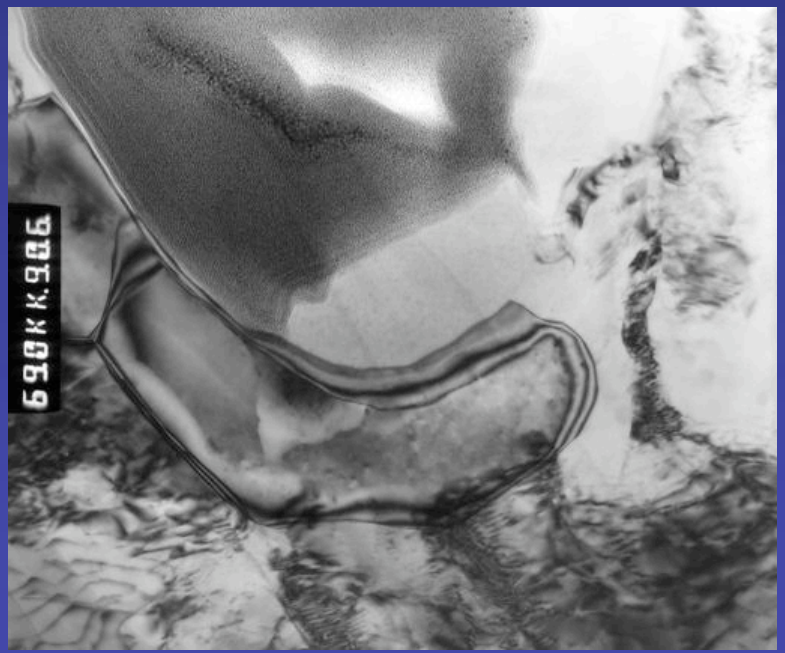
Area of interest with different Bragg condition

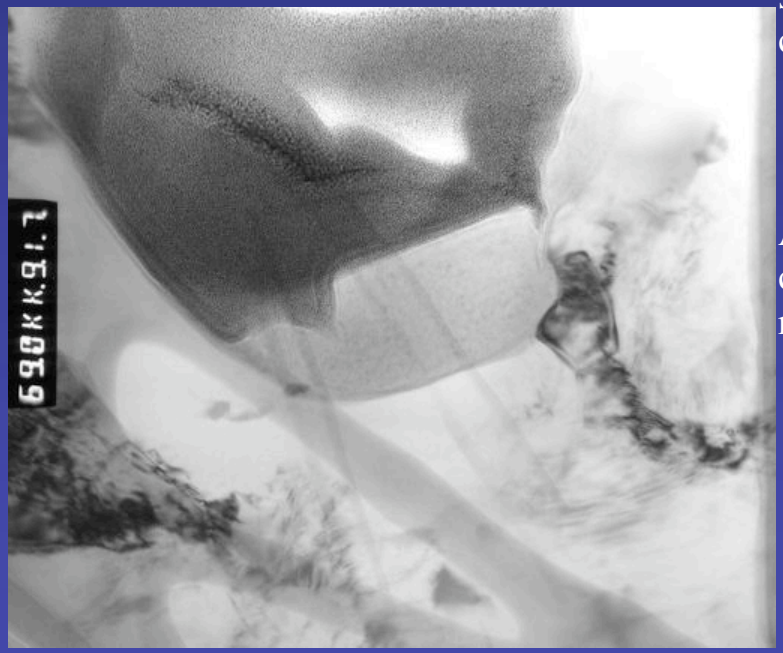


O-Mg-Si particle

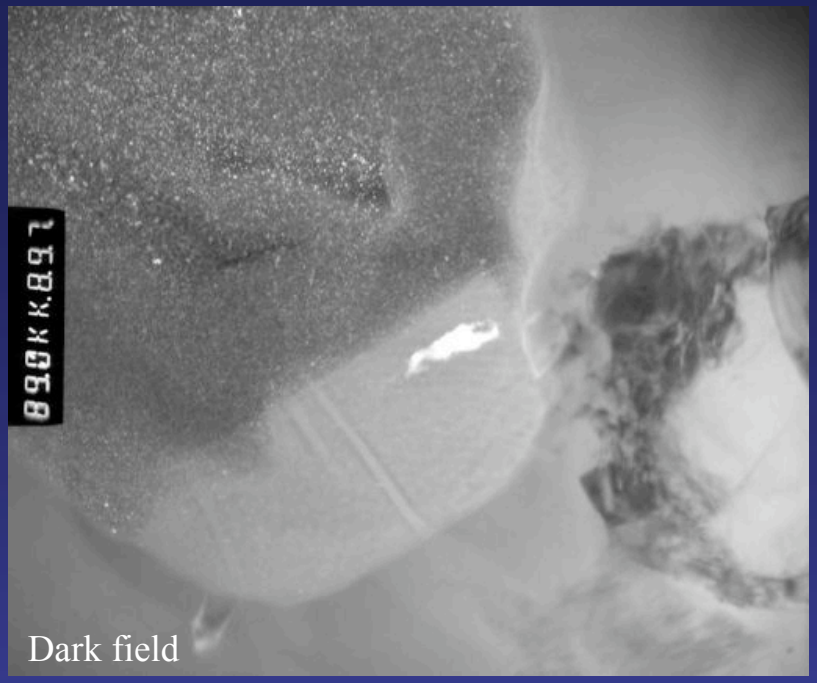


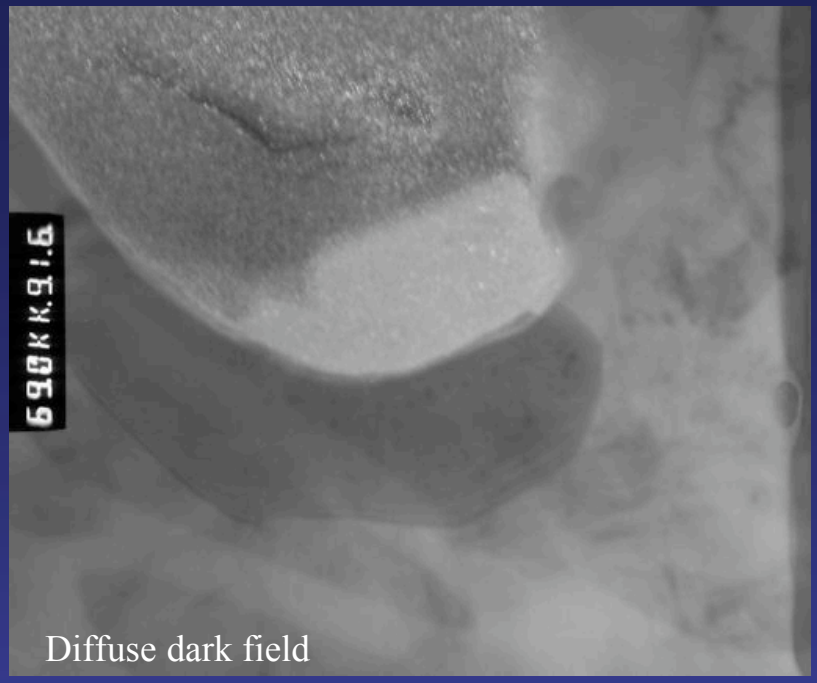
Weak bragg contrast: the particle is mainly amorphous but a small part is crystalline

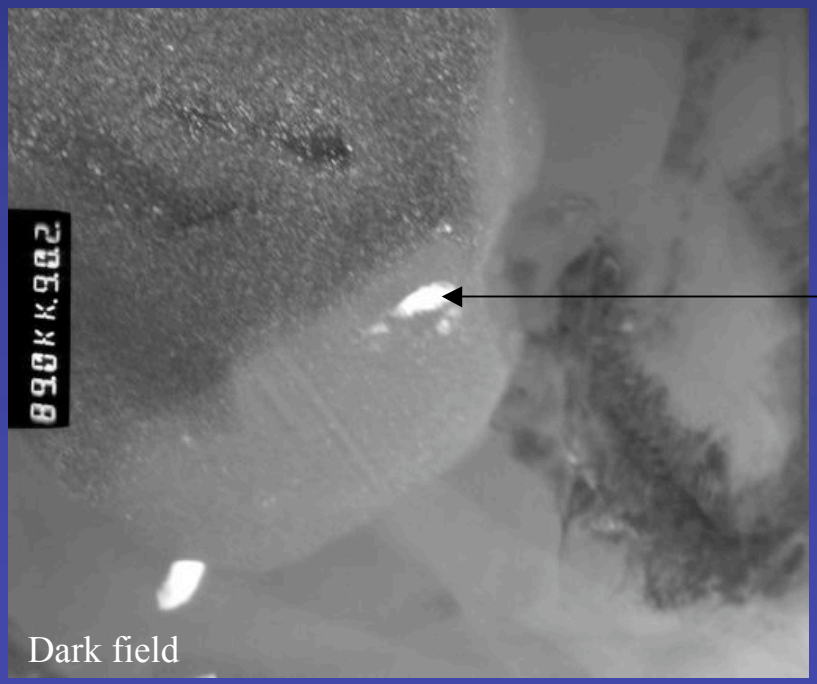


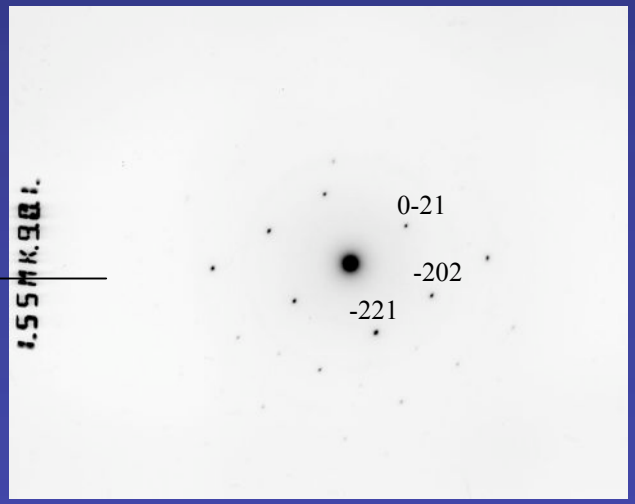


Aluminium in the crater wall is recrystallized.









The measured distances are compatible with enstatite (indexed here as CPX)

0.330 nm = 021

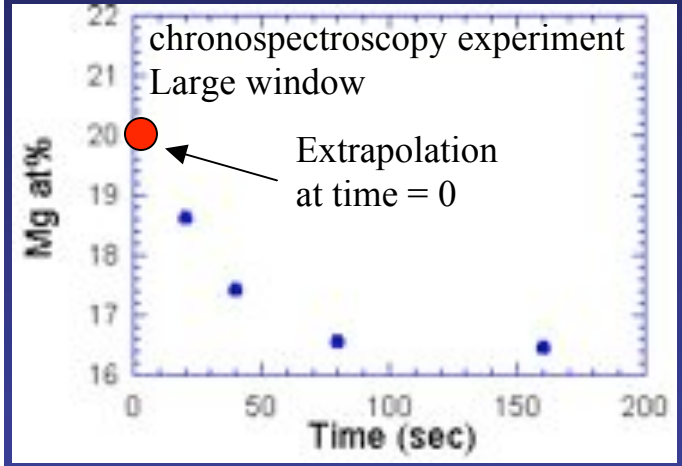
0.300 nm = -221

0.250 nm = -202

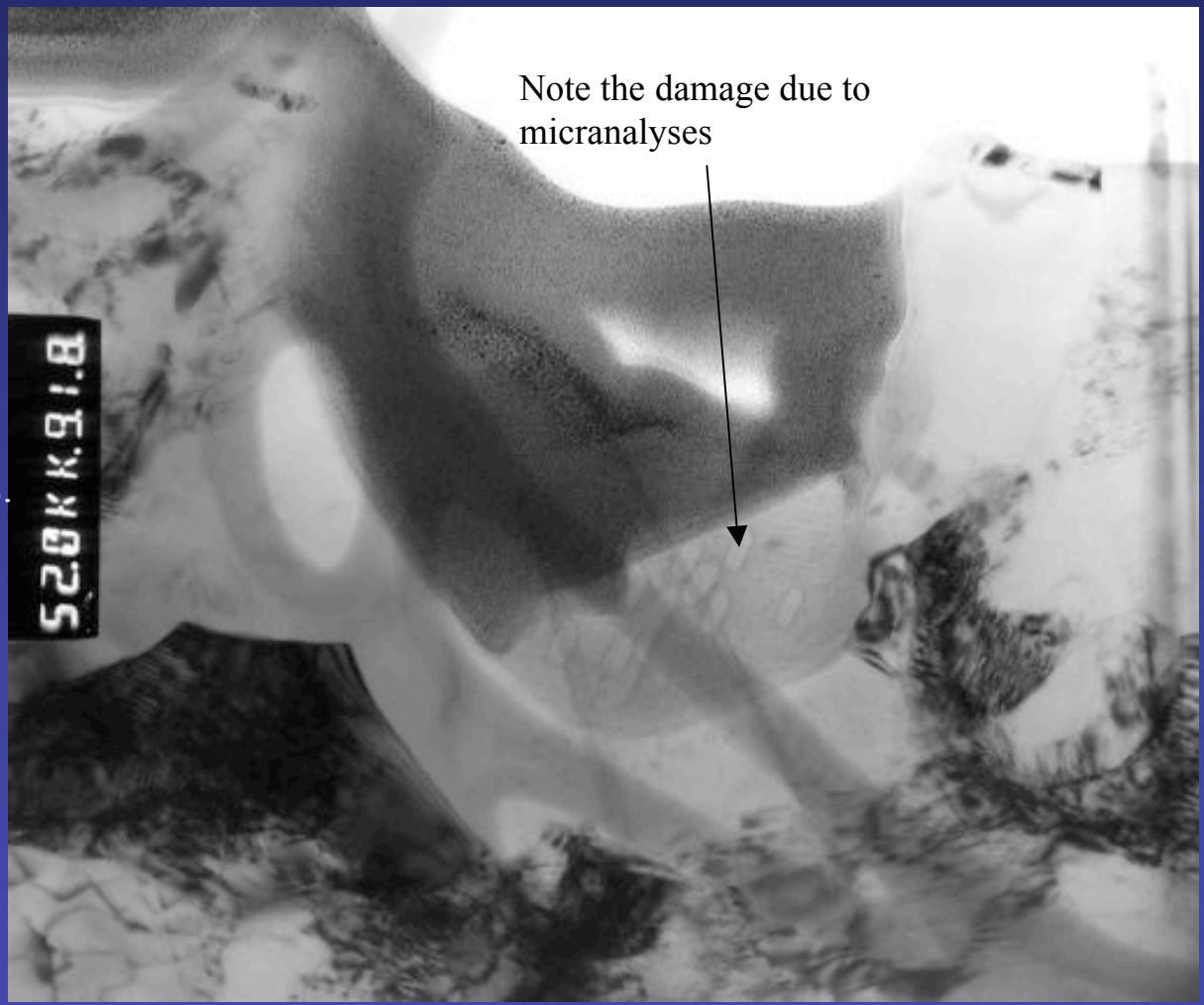
Angles are OK

Can be also be indexed as orthorhombic entstatite
0.33 nm = (-1 -2 1) ; 0.29 nm = (3 2 1) ; 0.25 nm = (2 0 2)

All quantitative microanalyses show that the Mg/Si ratio is below 1, within the range 0.88 - 0.45. But chronospectroscopy experiments also showed that the amorphous phase is strongly sensitive to the electron beam, with a significant loss of Mg during analysis, despite I used a window (not a spot), a relatively low beam intensity and a short duration for spectra recording. An extrapolation at time = 0 (i.e. no irradiation) shows that the Mg/Si ratio is close to 1 (Mg close to 20 at%).



The composition is very homogeneous. The particle might originate from a single crystalline grain. 10 analyses have been recorded. The composition is $MgSiO_3$. Minor elements are:
Ca = 0.20 at%
Ti = 0.05 at%
Cr = 0.35 at %
Mn = 0.10 at %
Fe = 0.30 at%
Al = not measured



In summary this crater seems to contain an implanted particle (enstatite $MgSiO_3$), very homogeneous in composition. The particle might originate from a single crystalline grain. The amorphous state is probably due to the shock event. A small part remains crystalline.

The sample is no more available (destroyed under the beam – sorry for that …).