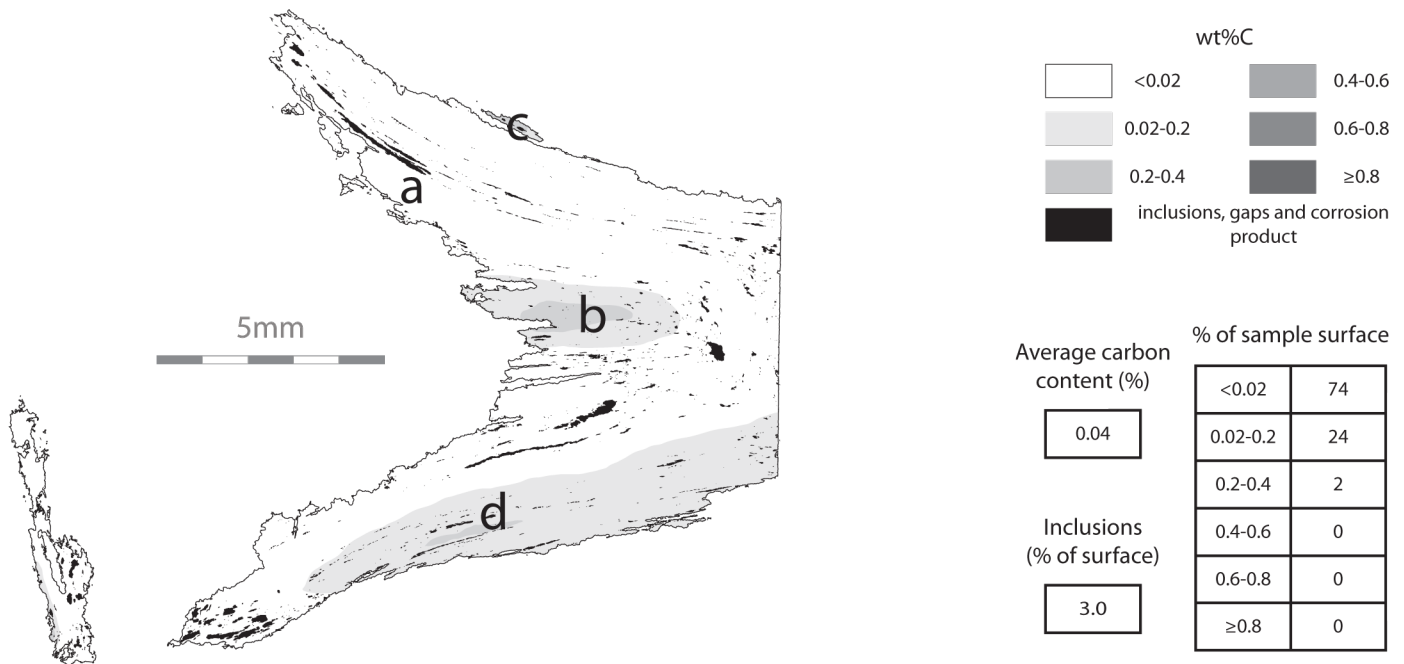
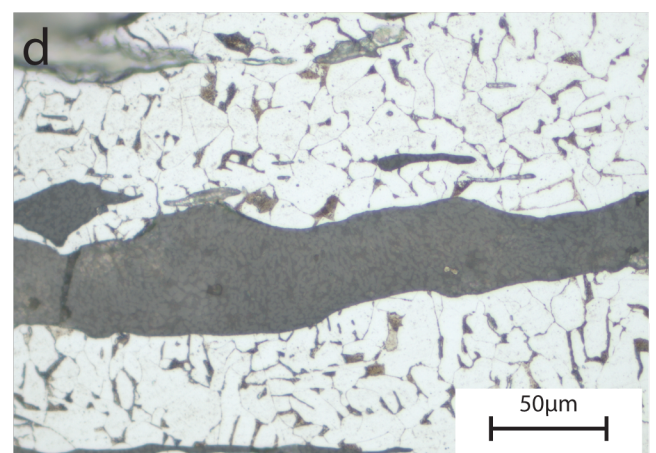
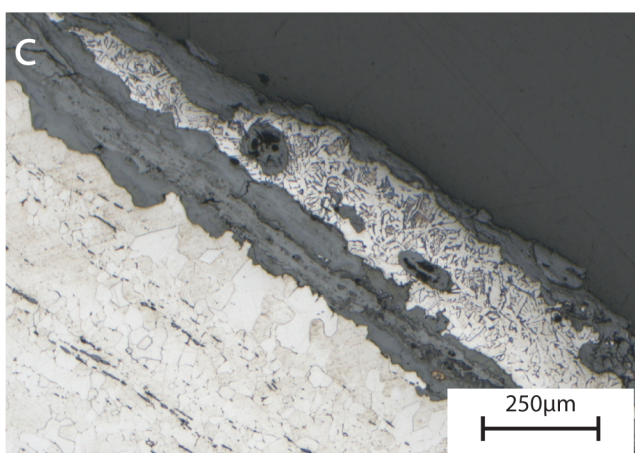
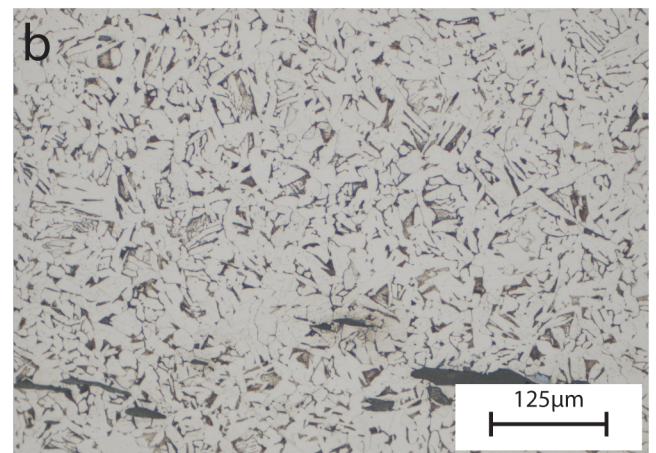
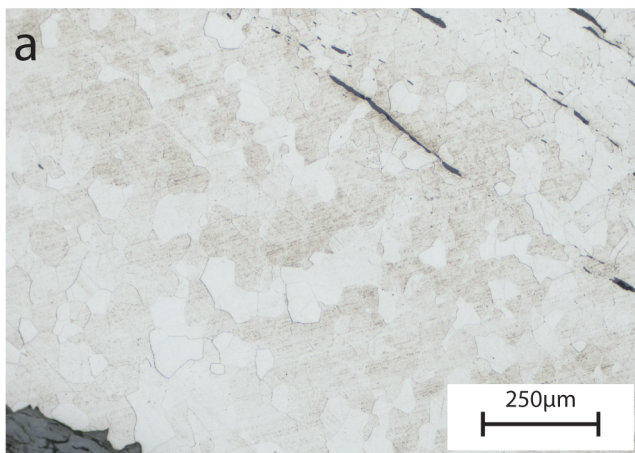




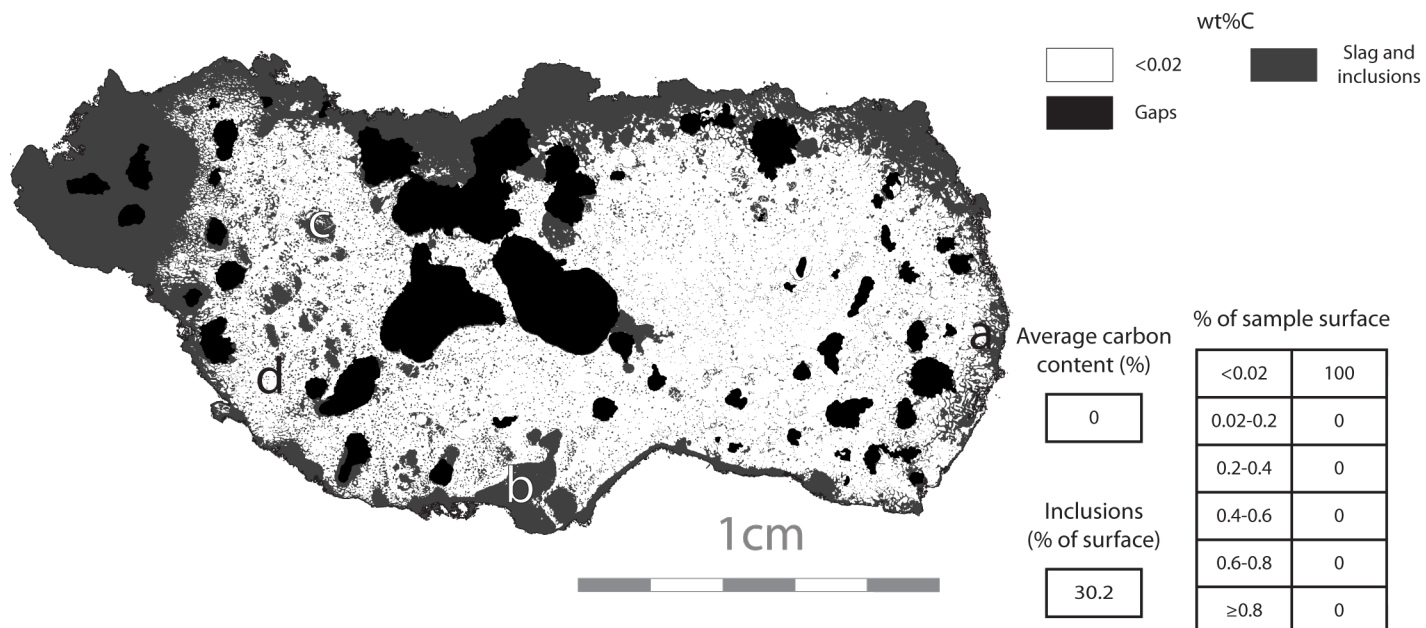
OEG 164



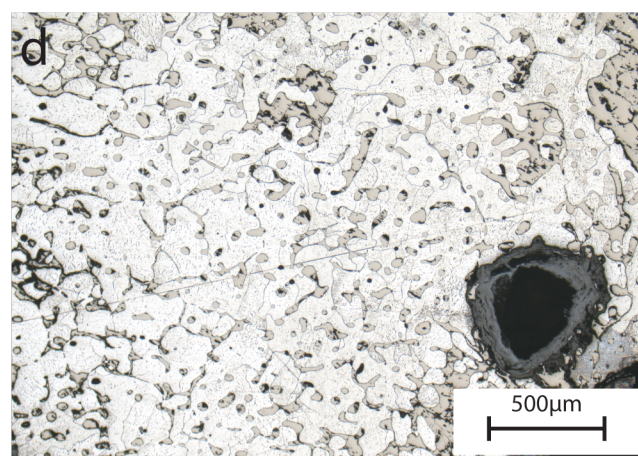
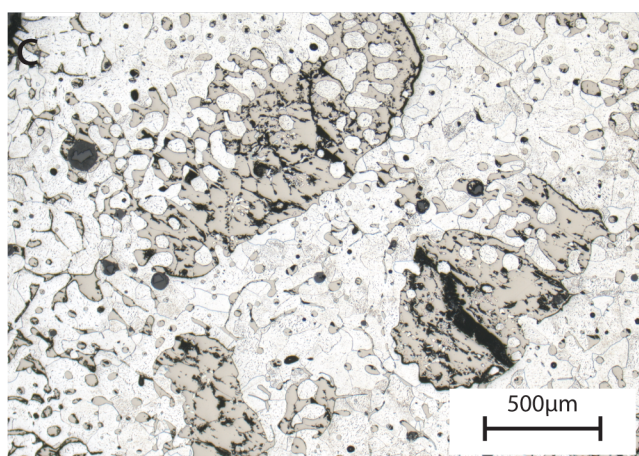
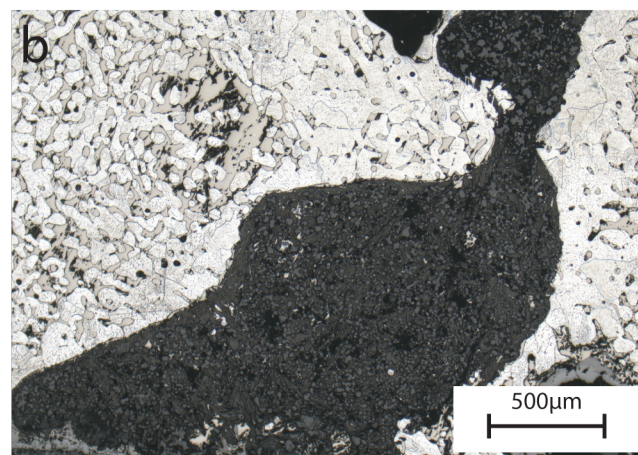
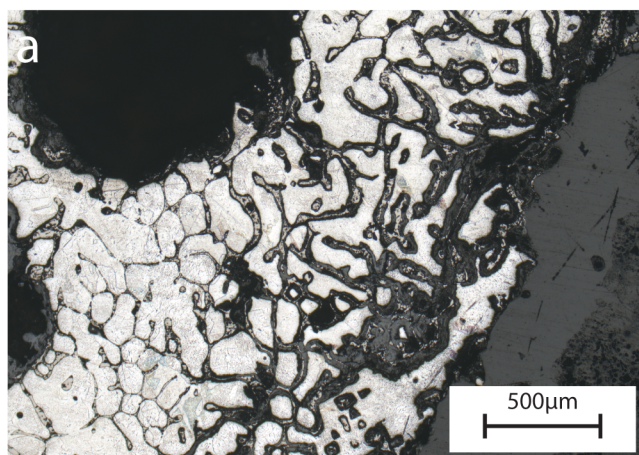
Bent iron bar, possibly a nail. Mostly ferrite (a) but clear bands of low carbon steel in the centre and along the edges. The pearlite forms Widmanstätten patterns (b, c) suggesting that it was left to cool slowly. The inclusions follow the direction of forging, and contain very small fayalite crystals (d).



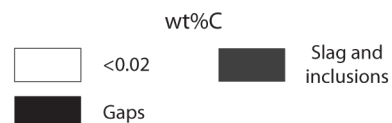
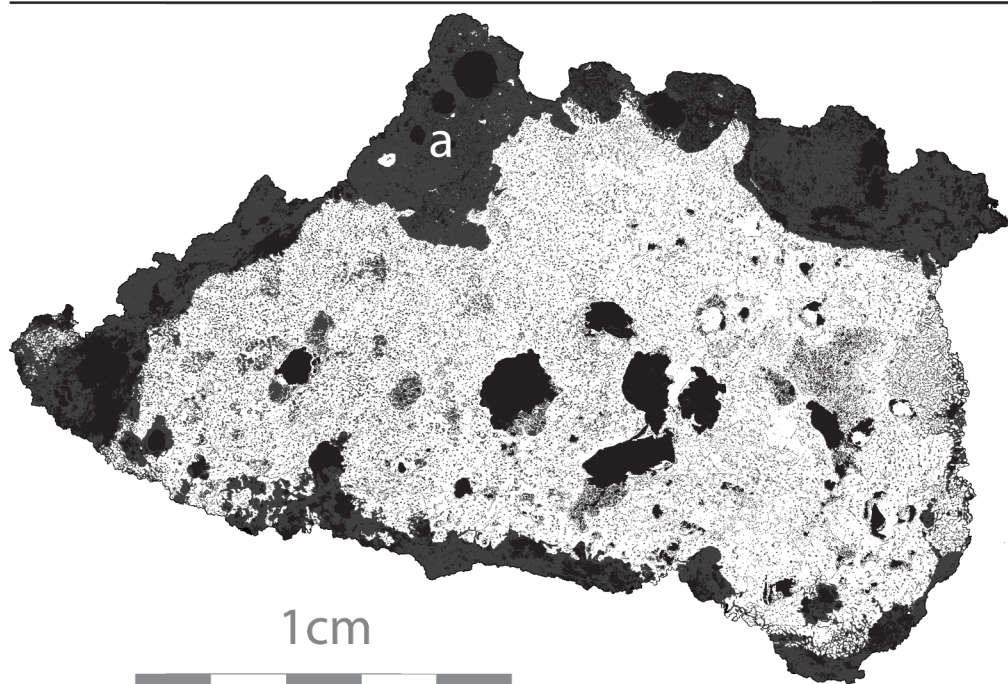
OEG 180A1



Small piece of iron. In all likelihood part of an unconsolidated bloom. The entire piece was wrapped in a slag gangue and the piece was filled with small beige inclusions. These inclusions were identified as some form of iron sulfide by SEM-EDX and tentatively as pyrrhotite (Fe_7S_8) by Raman spectroscopy.



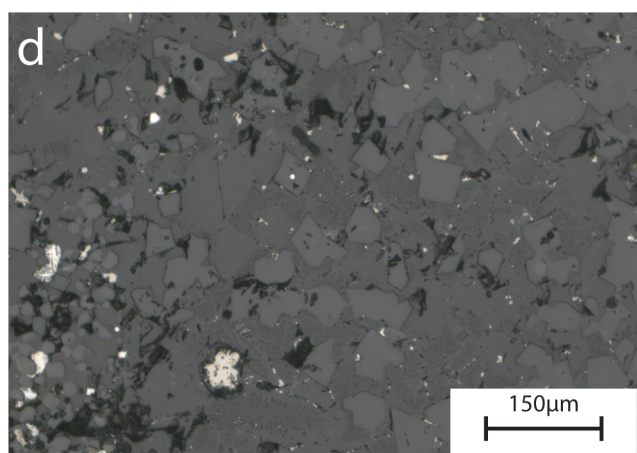
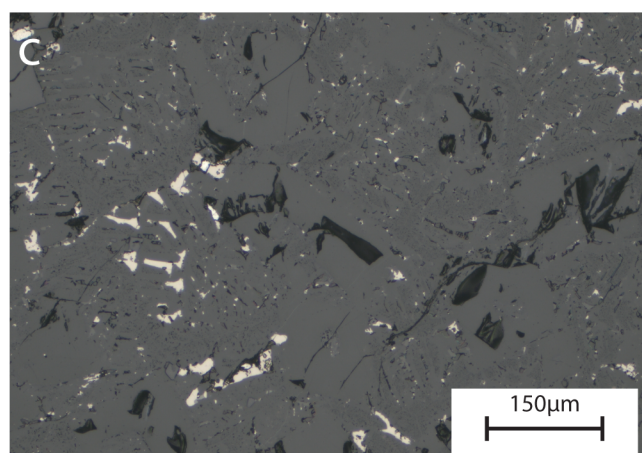
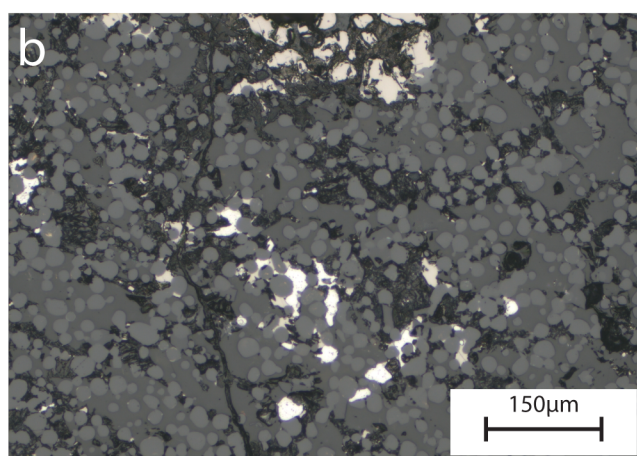
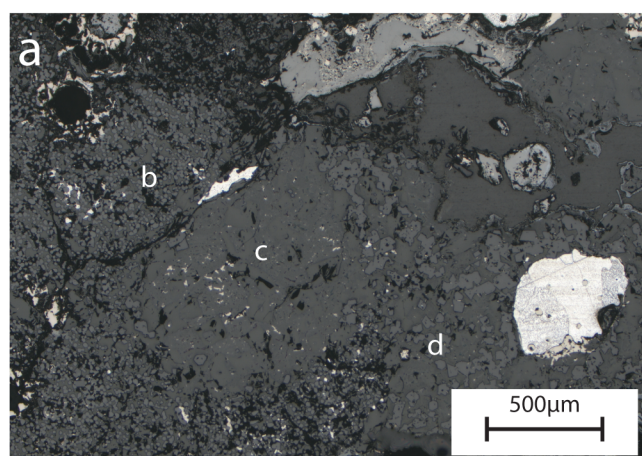
OEG 180A2



Average carbon content (%)	% of sample surface	
	<0.02	100
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	0	
	0	
	0	
	0	
	0	
	0	
	0	
	0	

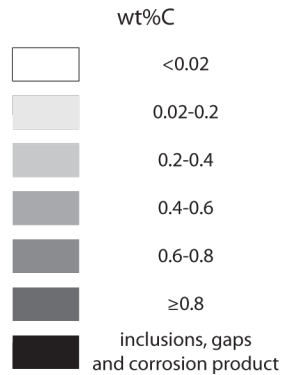
Inclusions (% of surface)	% of sample surface	
	<0.02	100
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	0	
	0	
	0	
	0	
	0	
	0	
	0	
	0	

Small piece of iron. In all likelihood part of an unconsolidated bloom. The entire piece was wrapped in a slag gangue and the piece was filled with small beige inclusions. Three distinct facies were identified in the slag gangue. b had high Mg content, c had high Al and Ca content and d had high Al and Mg content.





OEG 180B



% of sample surface

<0.02	100
0.02-0.2	0
0.2-0.4	0
0.4-0.6	0
0.6-0.8	0
≥0.8	0

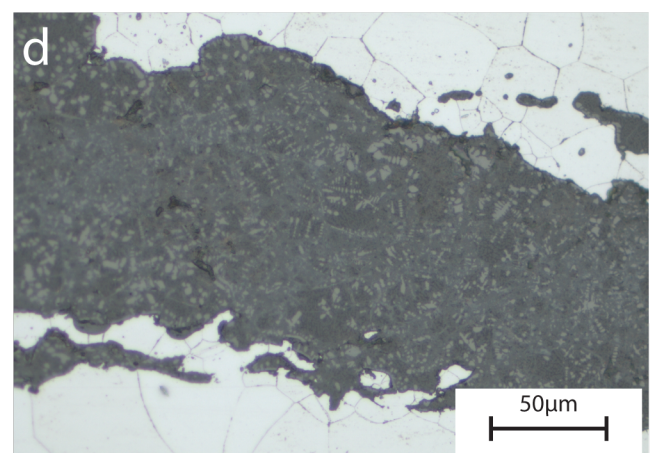
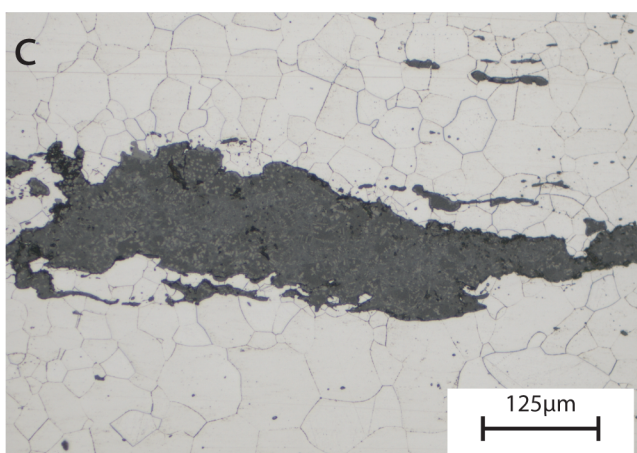
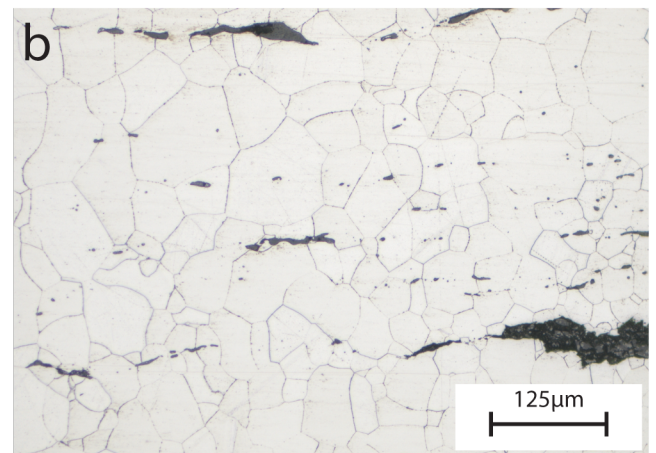
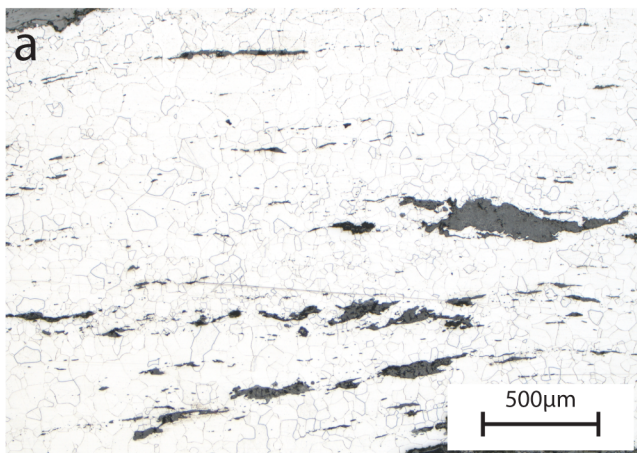
Average carbon content (%)

0

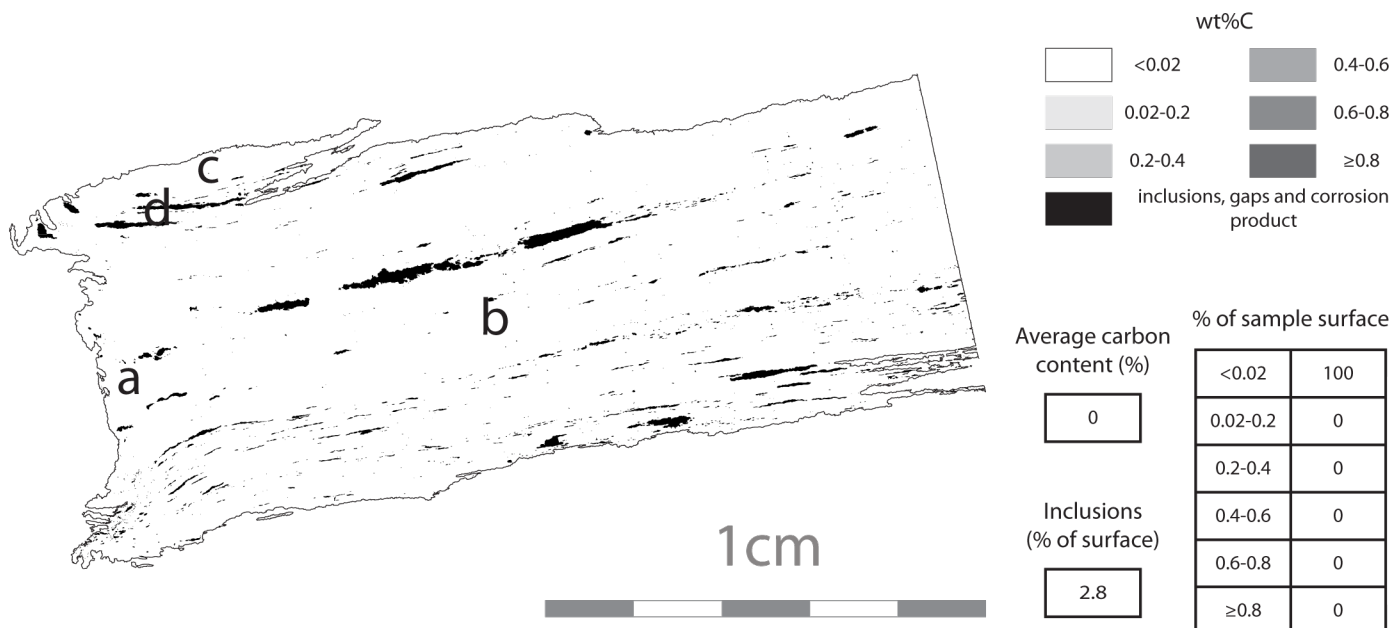
Inclusions (% of surface)

4.1

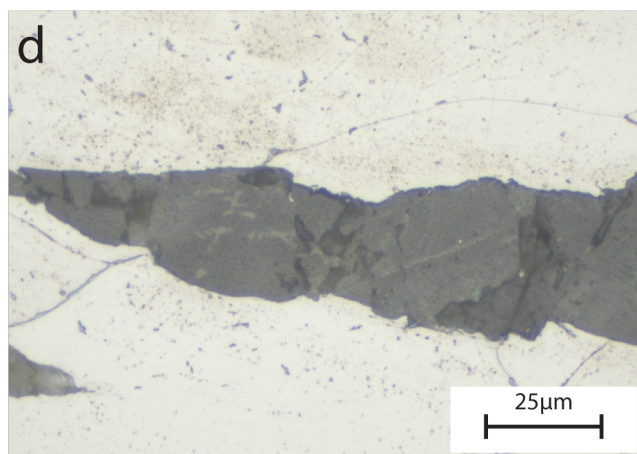
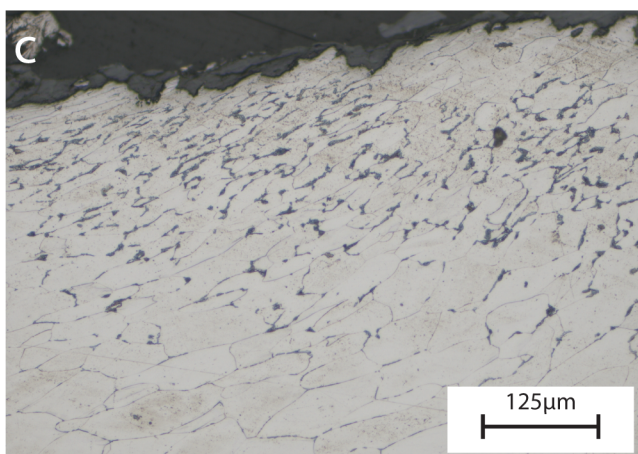
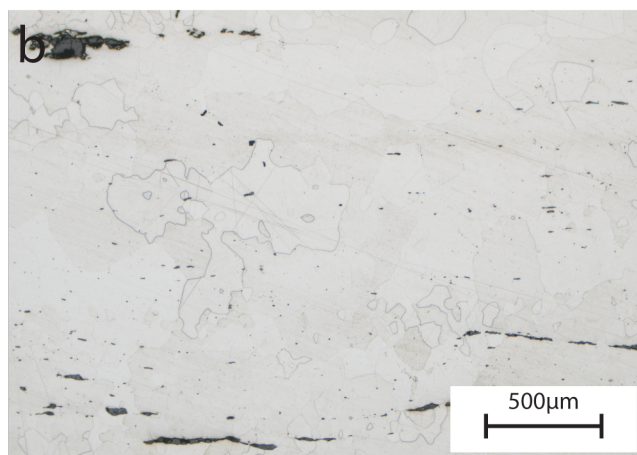
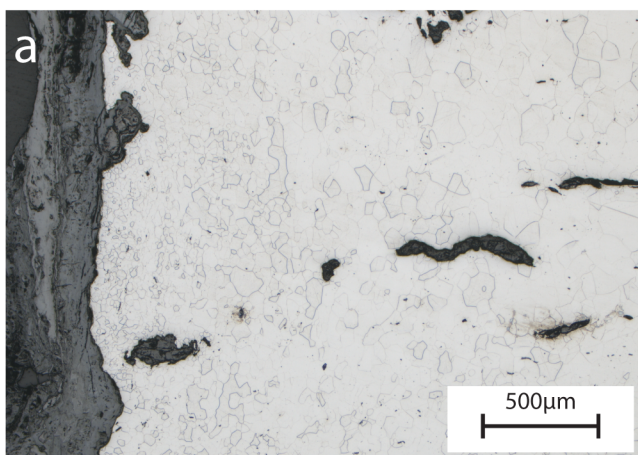
Nail, found with OEG 180A1 and 180A2. The piece is entirely ferrite (a, b). Most inclusions are corrosion product though several contain fayalite and wüstite (c, d). Chemical analysis found that the slag inclusions contain copper, similar to OEG 2540, though without the unusual corrosion product.



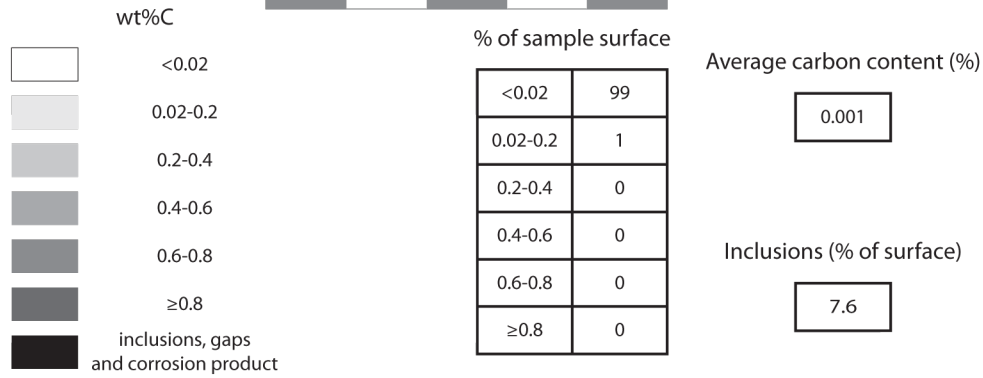
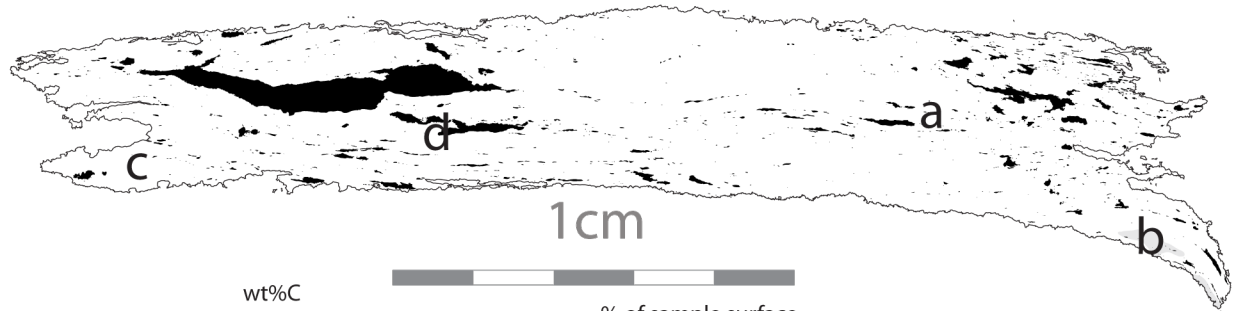
OEG 221



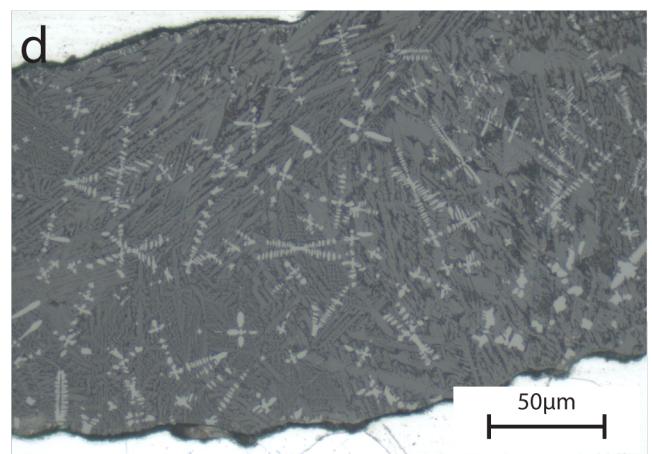
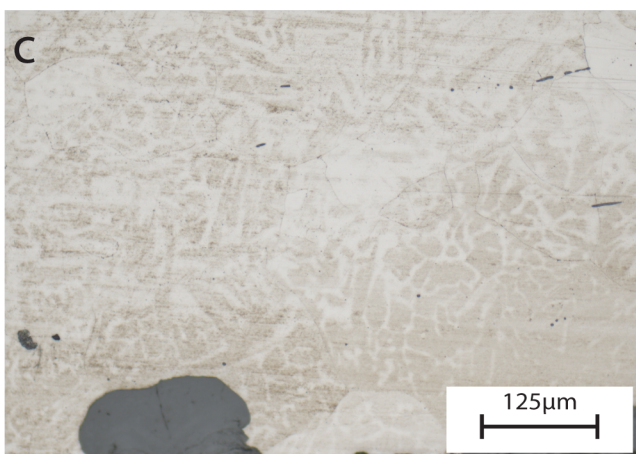
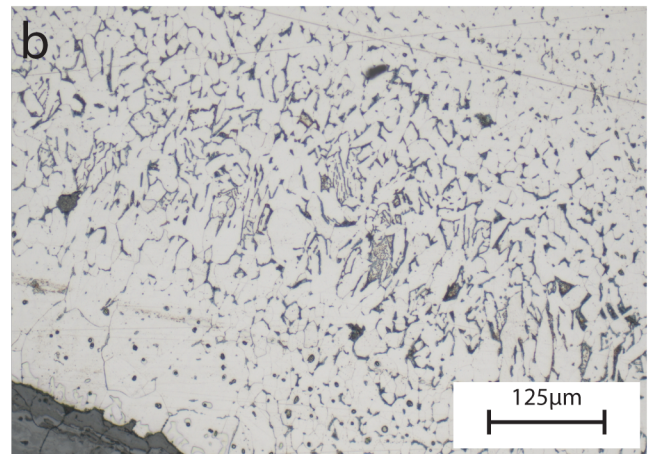
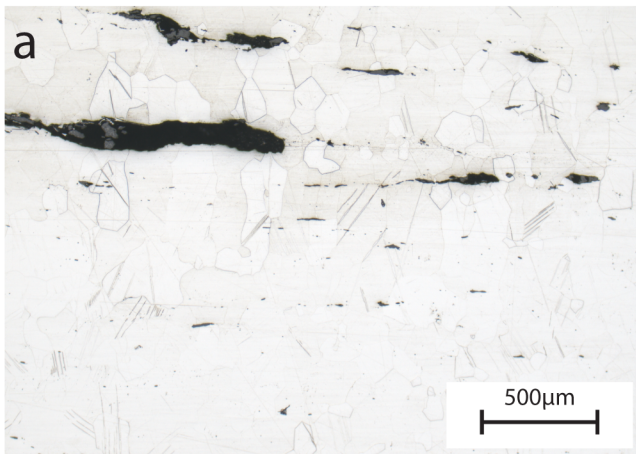
Very large iron nail. Was identified as a possible boat nail but due to the very large head and the octagonal shape of the shaft, it could be more recent, possibly a stone chisel. The metallurgy doesn't give any indication, being entirely ferrite (a, b) with some visible flattening of the grain towards the edge (c).



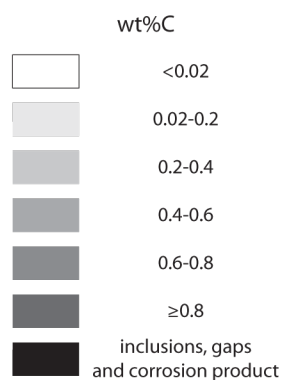
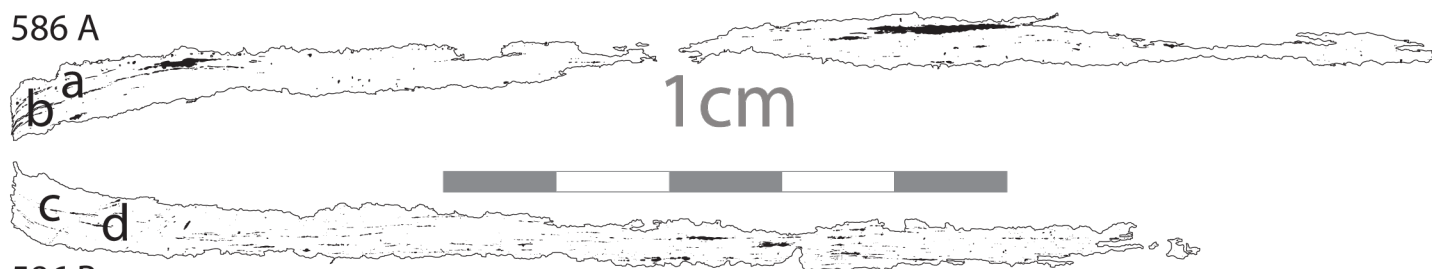
OEG 435



Large iron nail, entirely ferrite (a) barring some hypo-eutectoid steel near the head (b). This is best explained by mild recarburation in the hearth. Some of the ferrite grains show twinning (a) suggesting a plastic deformation. Some phosphorus ghost structures towards the end (c).



OEG 586



% of sample surface

<0.02	100
0.02-0.2	0
0.2-0.4	0
0.4-0.6	0
0.6-0.8	0
≥0.8	0

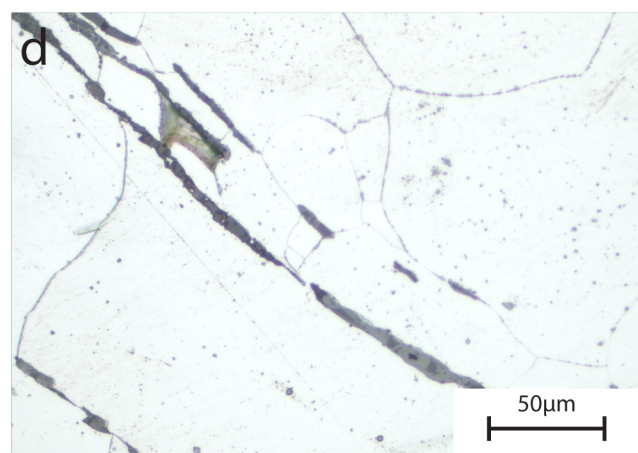
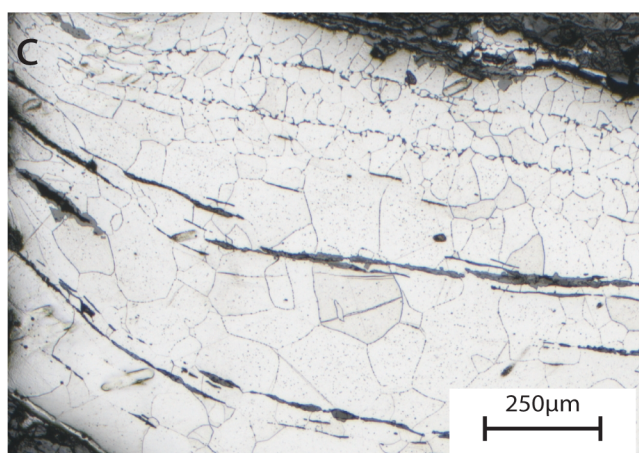
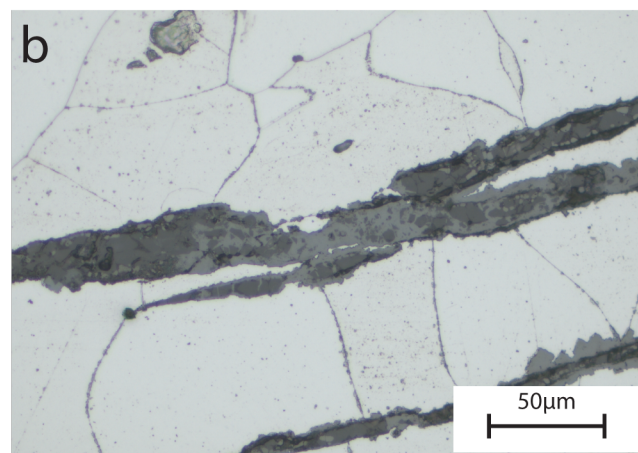
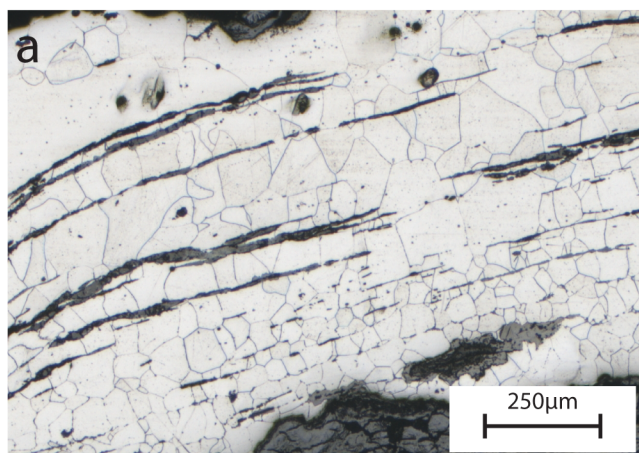
Average carbon content (%)

0

Inclusions (% of surface)

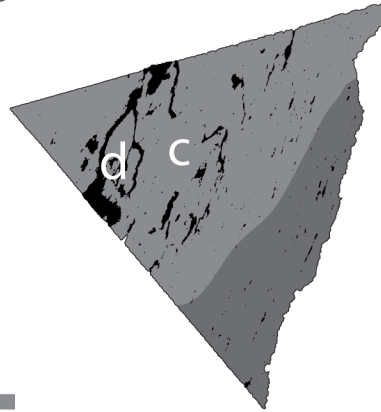
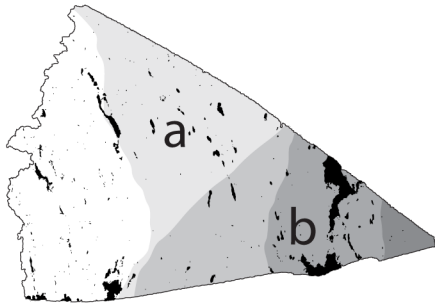
3.6

Small iron offcut, entirely made of ferrite (a). Both halves were embedded. The curve of the inclusions at the end show the location of the cut. The grain appears to be bounded by the inclusions (a, b). The inclusions seem to be mostly corrosion product though some of them contain some spinels (b).





OEG 968 sub 1



1cm

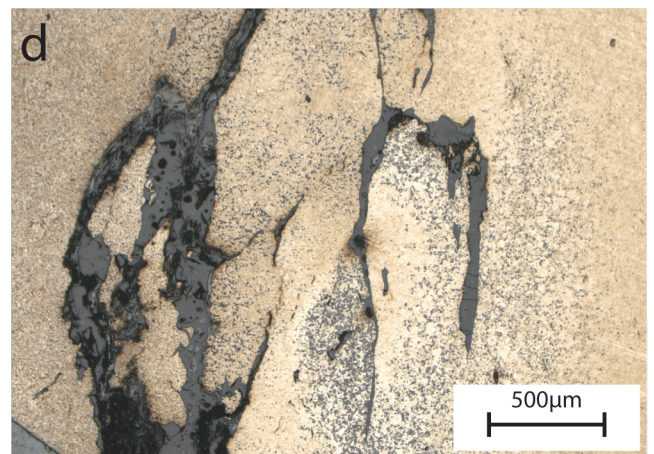
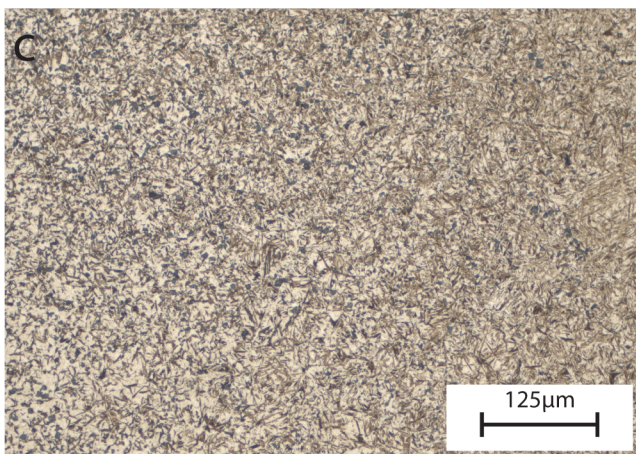
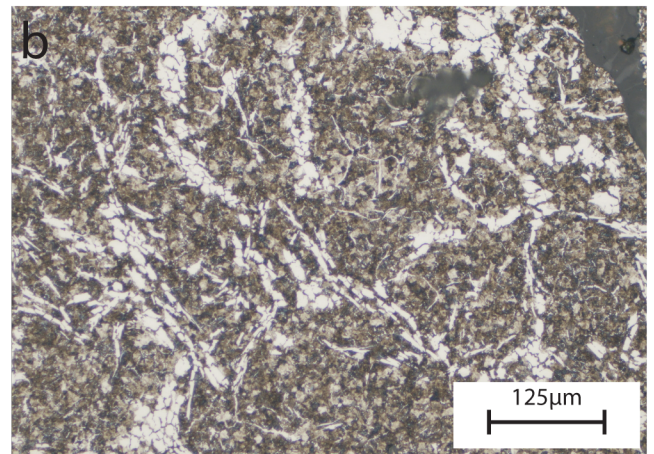
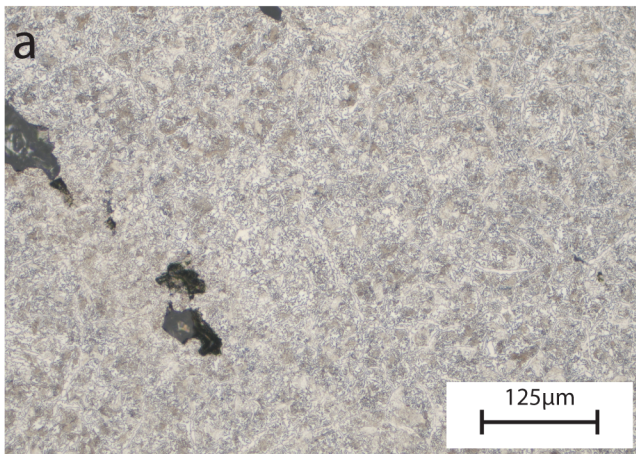


- Eutectoid
- Hyper-eutectoid 1
- Hyper-eutectoid 2
- inclusions, gaps and corrosion product
- Hyper-eutectoid 3
- Martensite
- Bainite?

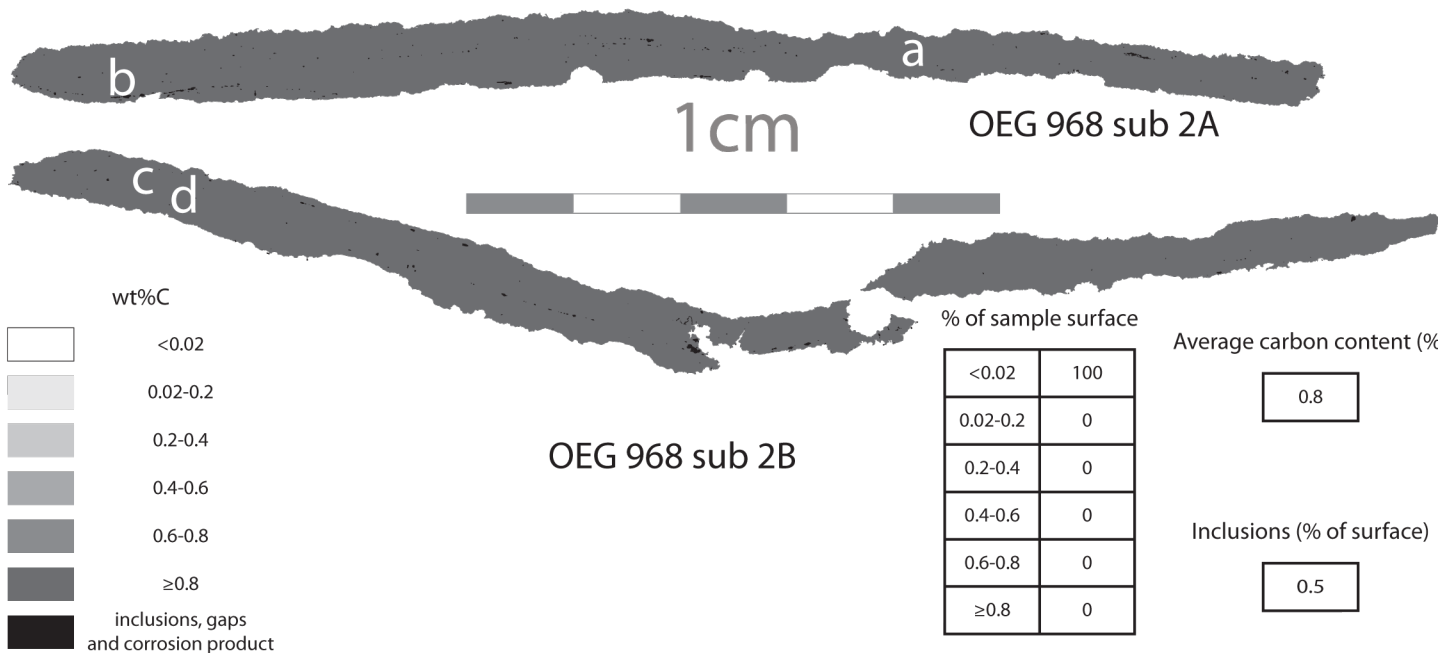
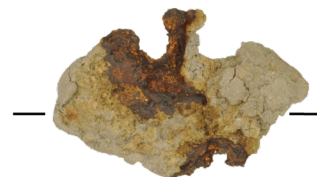
Average carbon content (%)	% of sample surface	
<0.02	0	
0.02-0.2	0	
0.2-0.4	0	
0.4-0.6	0	
0.6-0.8	0	
≥0.8	100?	

Inclusions (% of surface)	
Impossible to determine	
5.4	

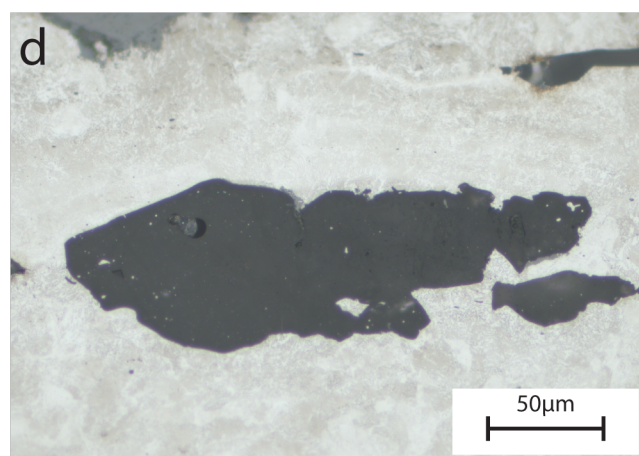
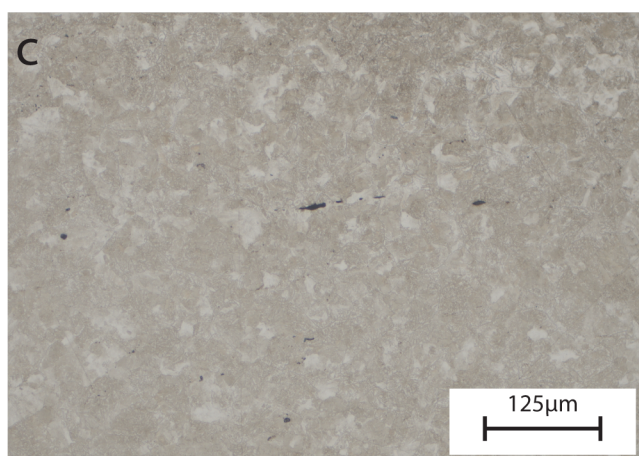
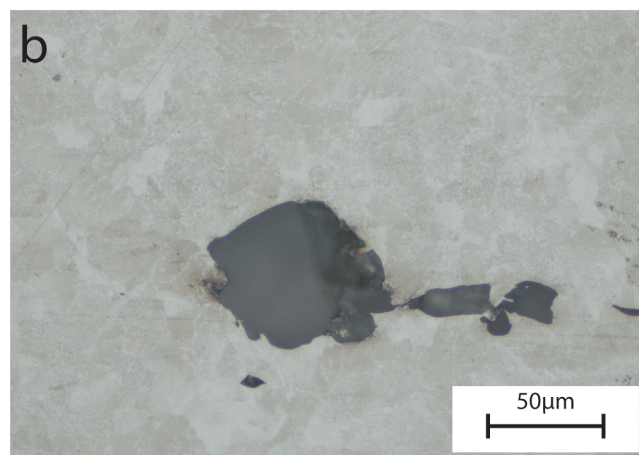
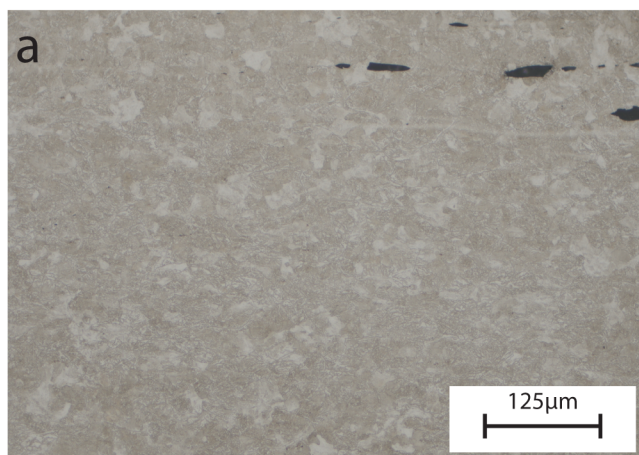
Fire striker. This object showed the most complex metallurgy out of all of the Oegstgeest samples (barring OEG 180A). The entire piece was hyper-euctectoid (a, b) steel with clear evidence of quenching along the working edge (c). A long line of inclusions ran through the entire length of the peice (d).



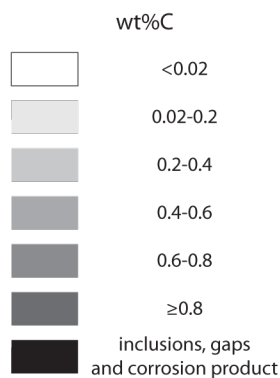
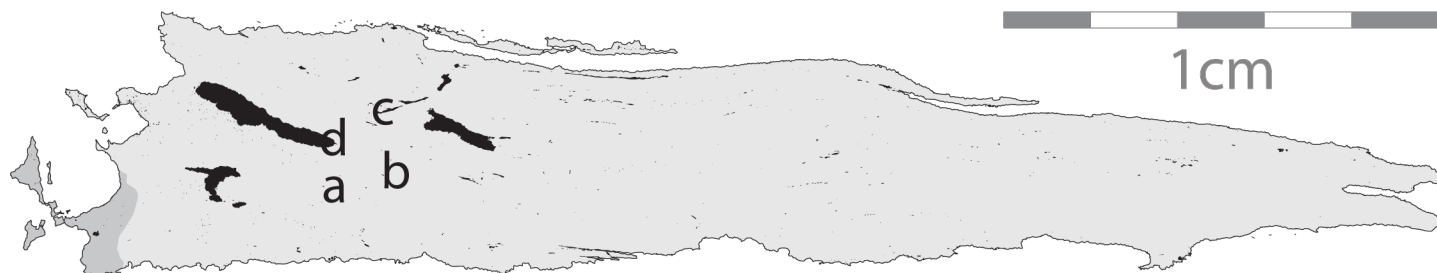
OEG 968 sub 2



Amorphous piece of iron, identified as a possible shard from a knife blade. Both sides were embedded. The whole piece is very homogenous eutectoid steel (a, c), which would be expected from a knife. No visible welds and only a few glassy inclusions with no wustite or visible fayalite (b, d).



OEG 968 sub 3



% of sample surface

<0.02	0
0.02-0.2	98
0.2-0.4	2
0.4-0.6	0
0.6-0.8	0
≥0.8	0

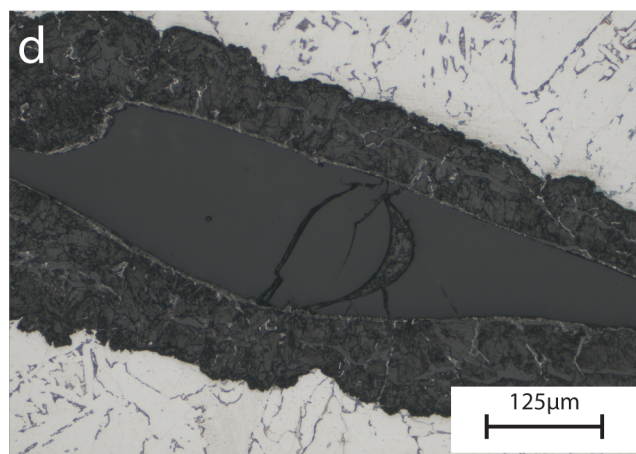
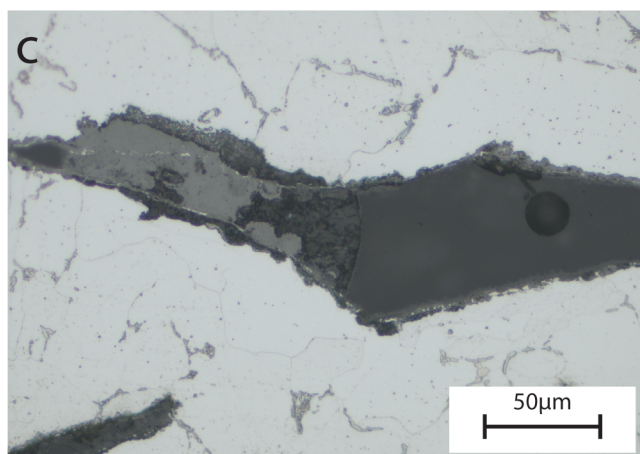
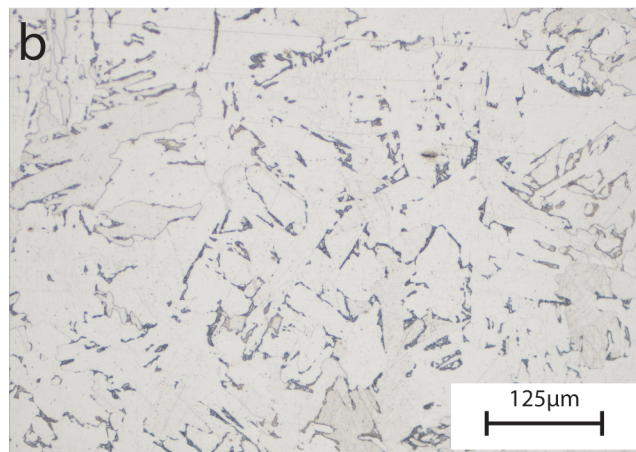
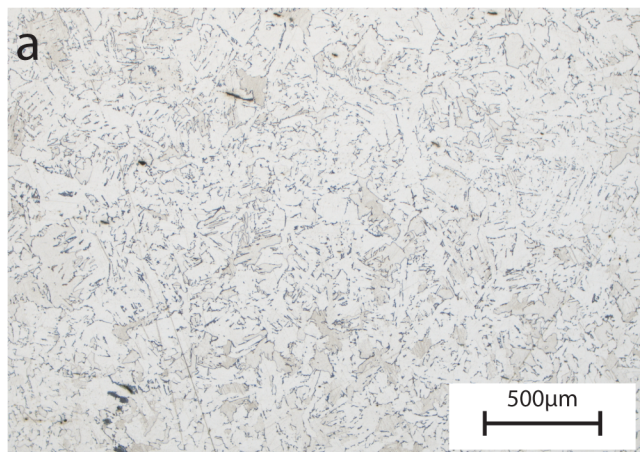
Average carbon content (%)

0.15

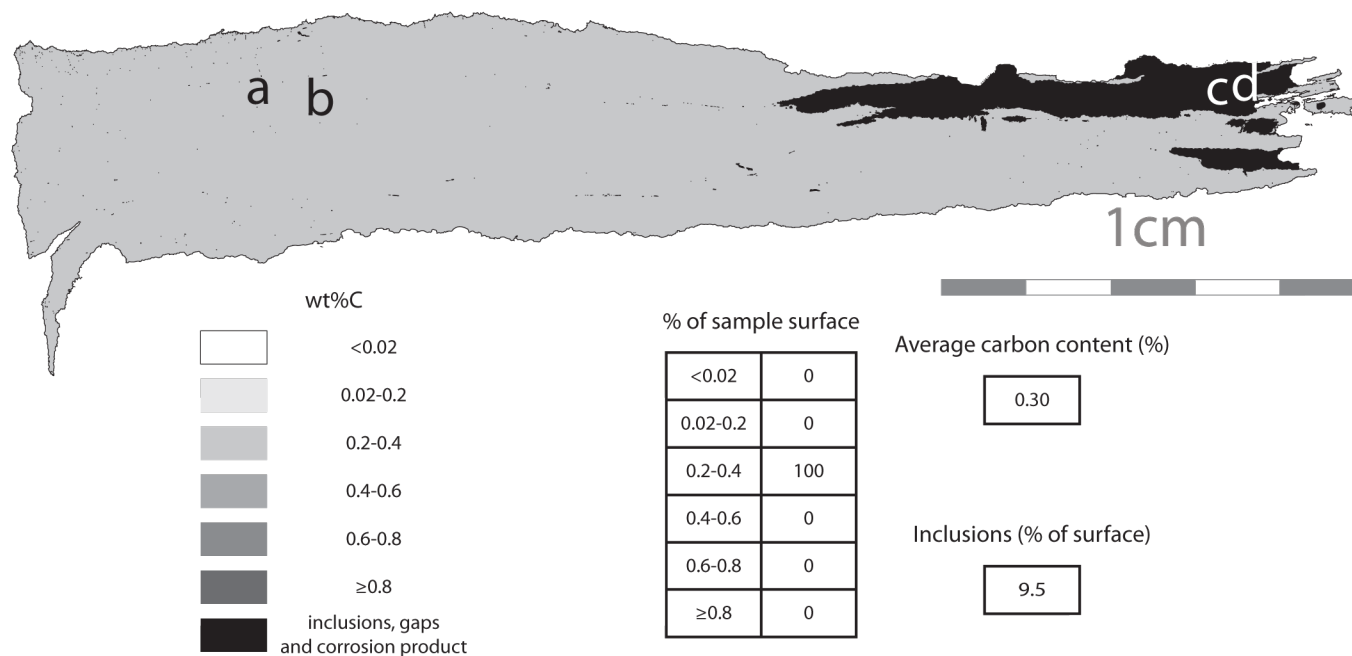
Inclusions (% of surface)

2.6

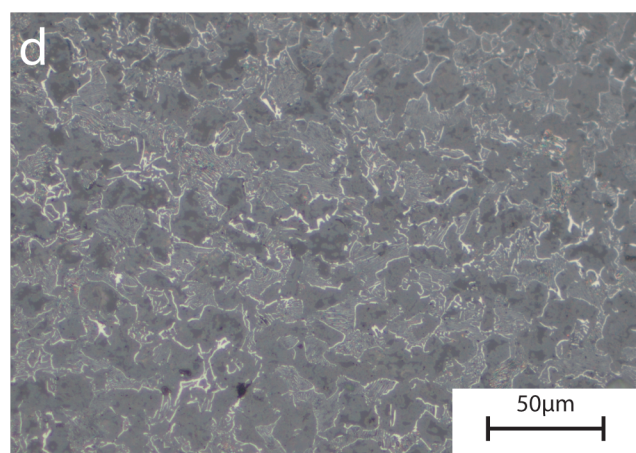
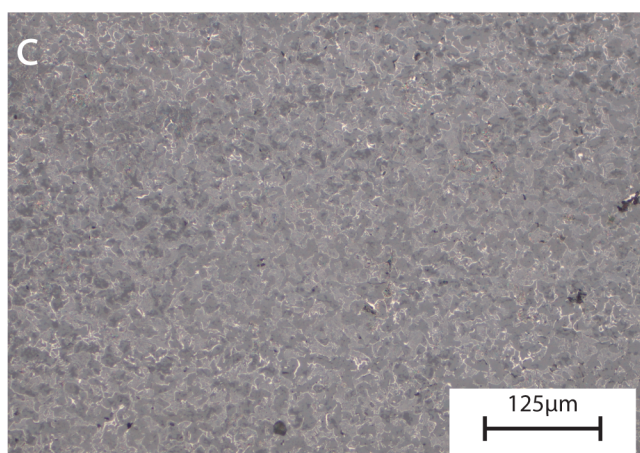
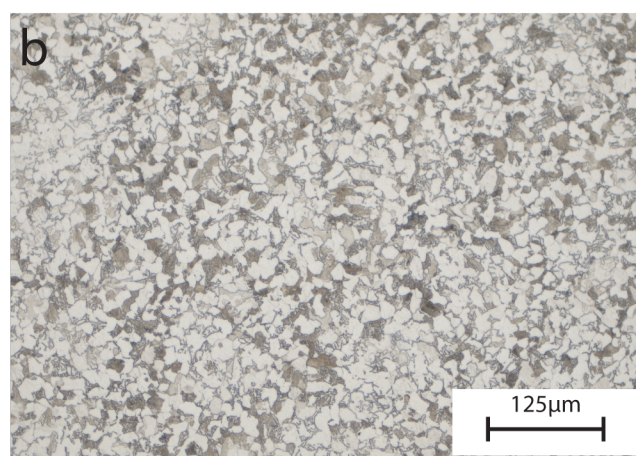
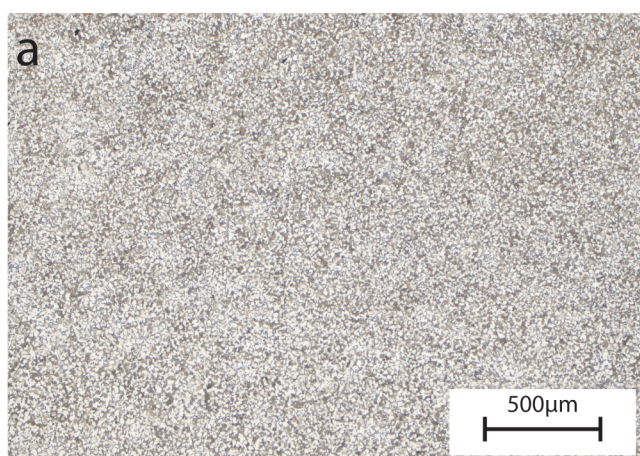
Nail, possibly a boat nail, found in Cluster A. The piece is entirely hypoeutectoid steel with some mild recarburation from the hearth towards the head. Widmanstätten patterns (a, b) are visible throughout the piece suggesting that it cooled slowly. Contains several large inclusions, mixture of glass and corrosion (c, d).



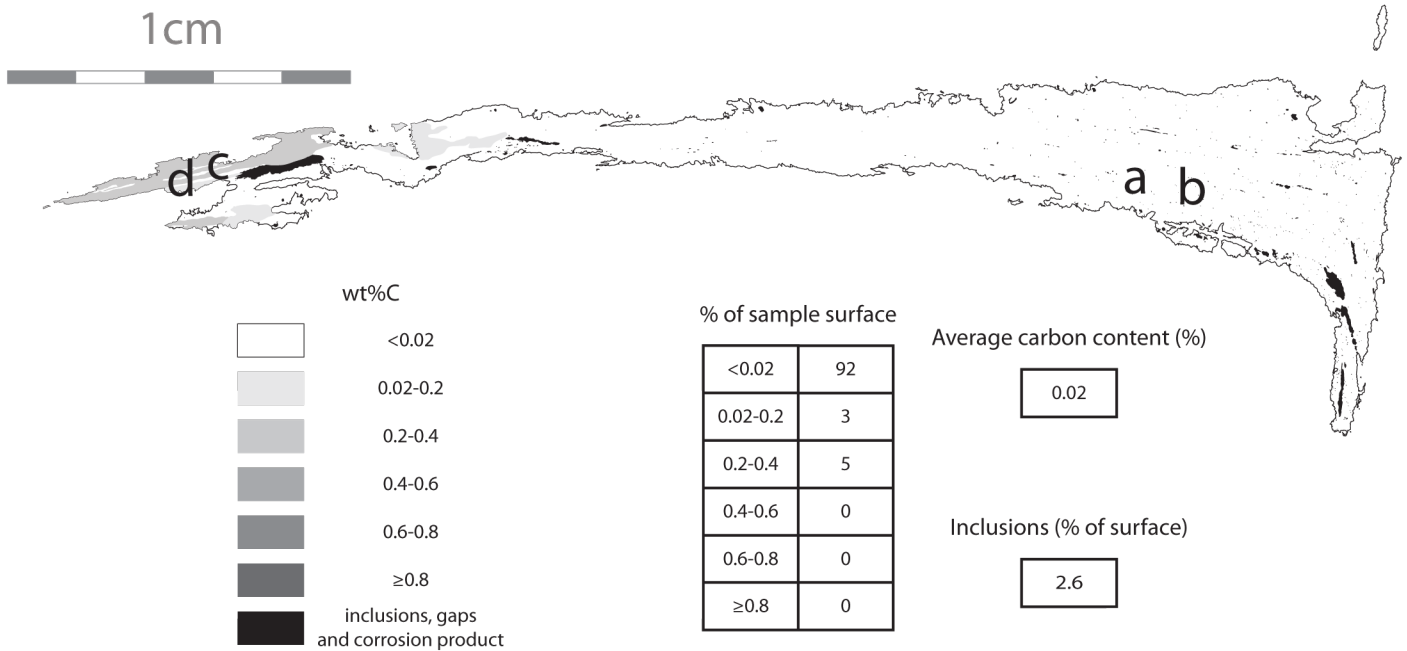
OEG 2540



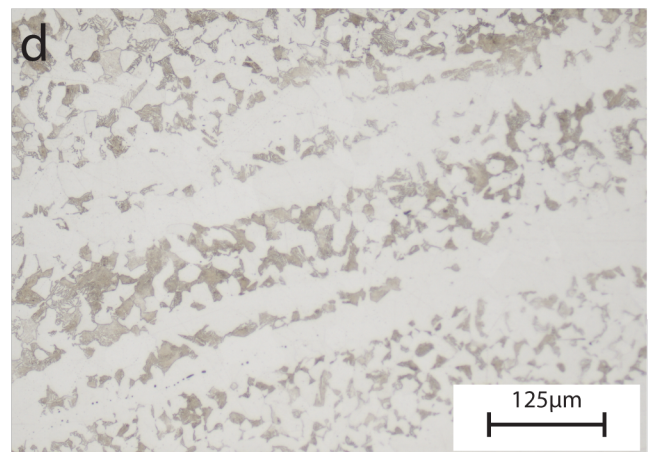
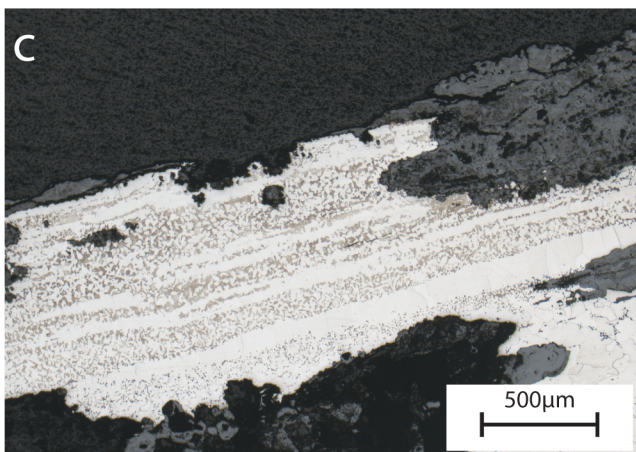
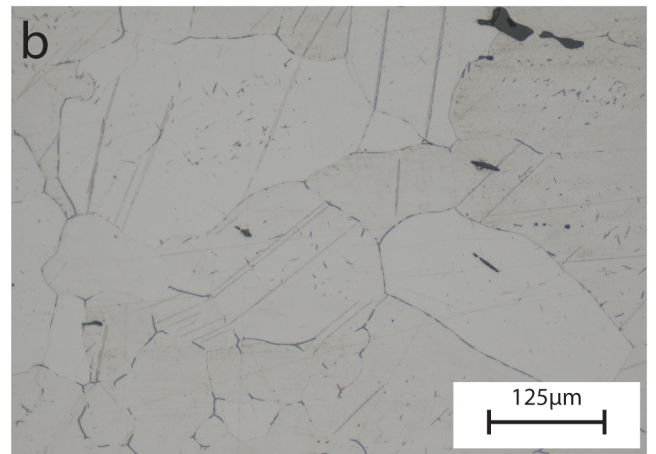
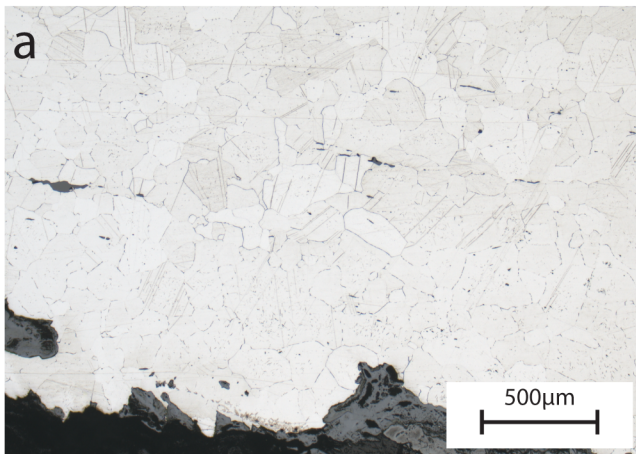
Nail, possibly a boat nail. The piece is homogenous hypoeutectoid steel (a), very similar to OEG 968 sub 3 though the the pearlite is globular rather than acicular. There is an unusual corrosion product (c) towards the end of the nail, possibly akaganeite. All inclusions were found to contain copper.



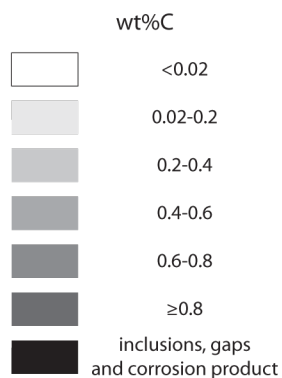
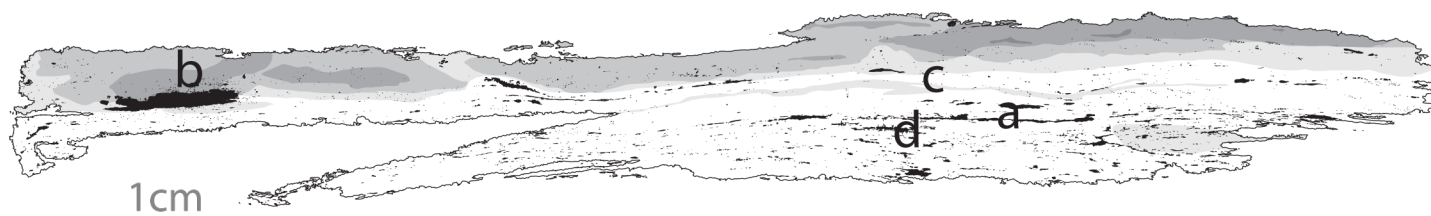
OEG 2546



Nail, possibly a boat nail. Mostly ferrite (a, b) with a small amount of hypo-eutectoid steel towards the edge (c, d). Given the shape before it was cut, it is possible that the other end was flattened as well but has since corroded. Twinning in the ferrite (a) suggests a mechanical deformation after cooling.



OEG 968 sub 3



% of sample surface

<0.02	58
0.02-0.2	14
0.2-0.4	18
0.4-0.6	10
0.6-0.8	0.2
≥0.8	0

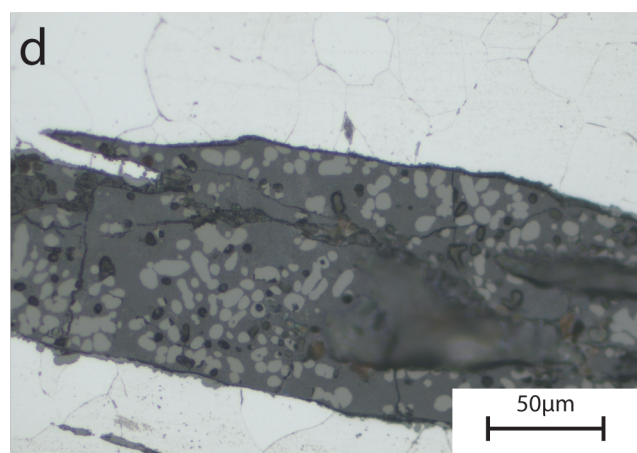
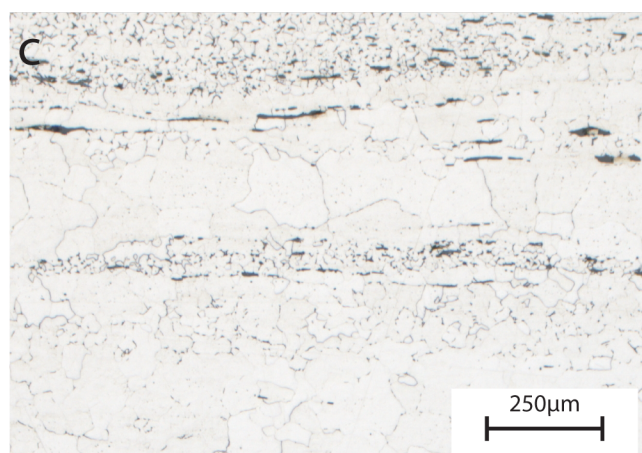
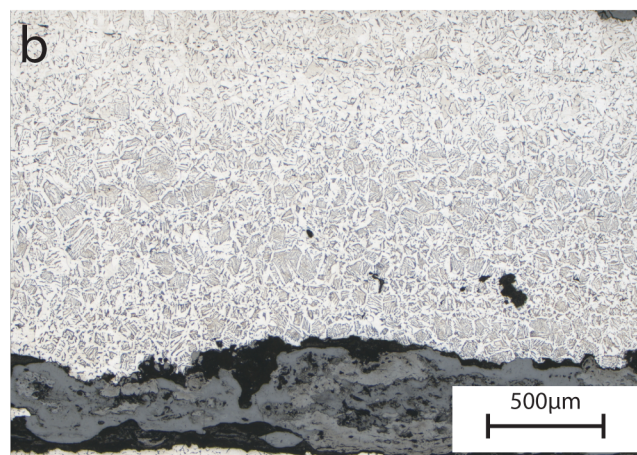
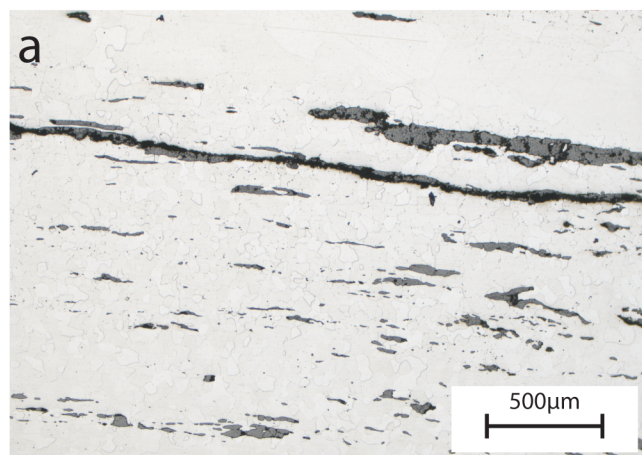
Average carbon content (%)

0.13

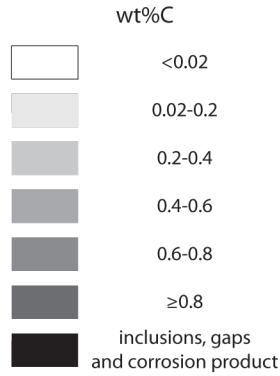
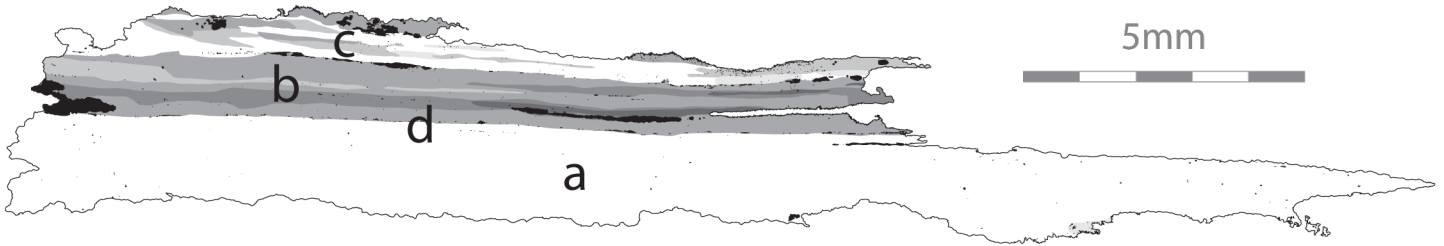
Inclusions (% of surface)

4.0

Nail, mixture of ferrite (a, c) and hypo-eutectoid steel of different carbon content (b). Very clear weld between the upper and lower halves with a number of small forge inclusions (c). Other inclusions are made of corrosion product (b) including a curiously shaped wedge and wüstite in a glassy matrix (d).



OEG 5355



% of sample surface

<0.02	69
0.02-0.2	1
0.2-0.4	5
0.4-0.6	19
0.6-0.8	5
≥0.8	1

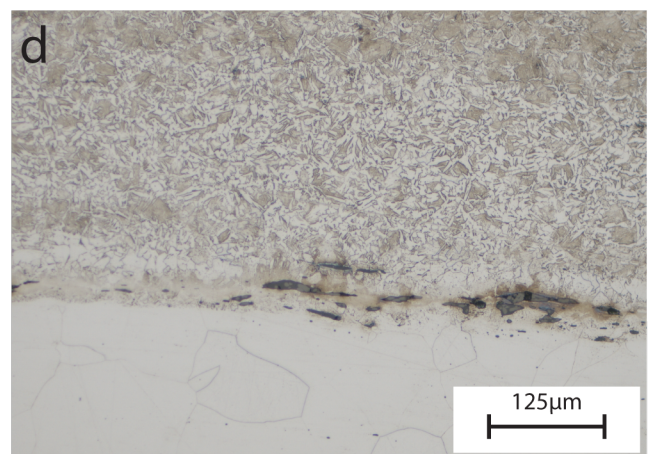
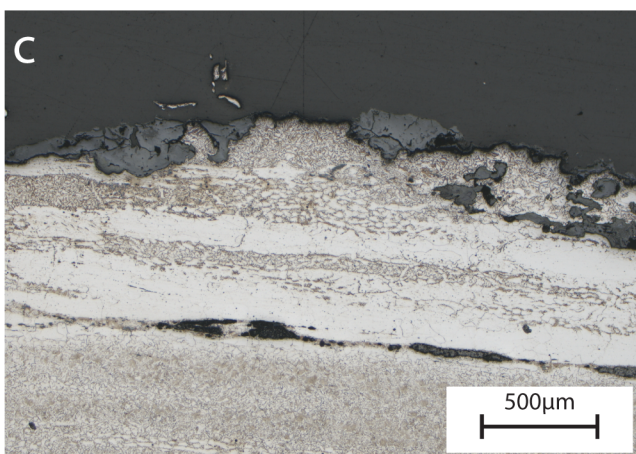
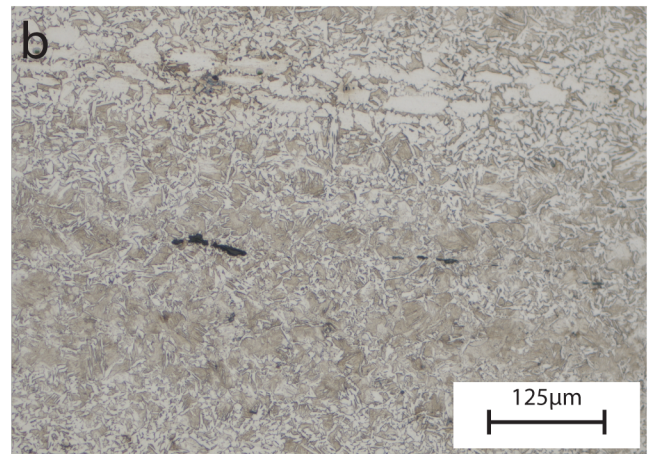
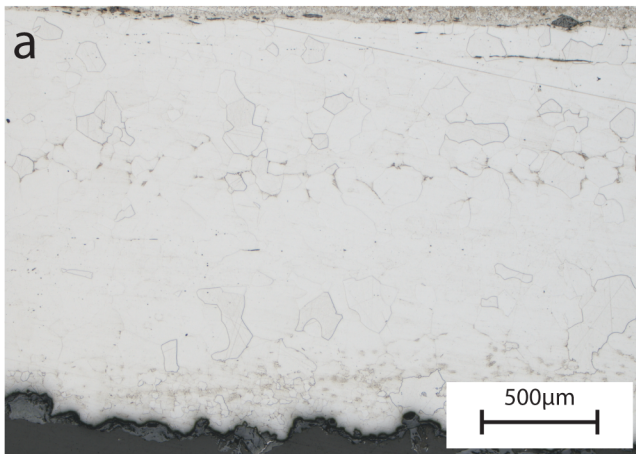
Average carbon content (%)

0.16

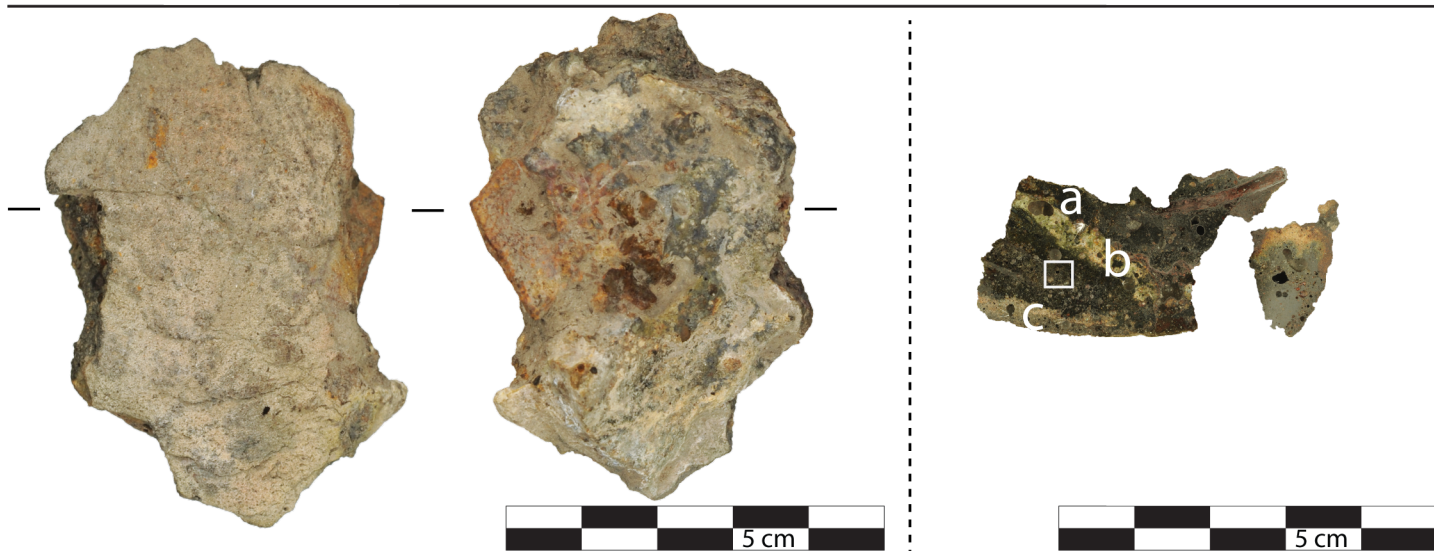
Inclusions (% of surface)

2.3

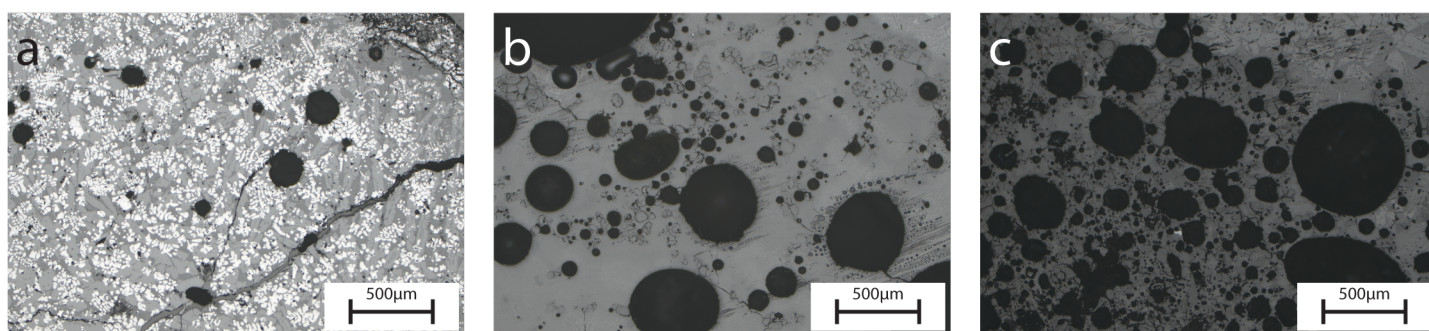
Small iron bar. Very clear weld along the centre separating ferritic iron from (hypo-)eutectoid steel in the centre. The metallurgy of the upper section is less clear with alternating bands of ferrite and hypo-eutectoid steel, possibly from folding, possibly from re-carburation in the hearth.



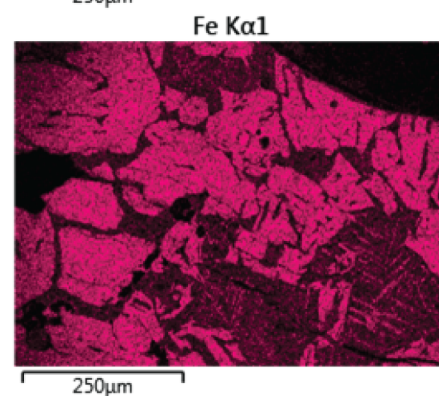
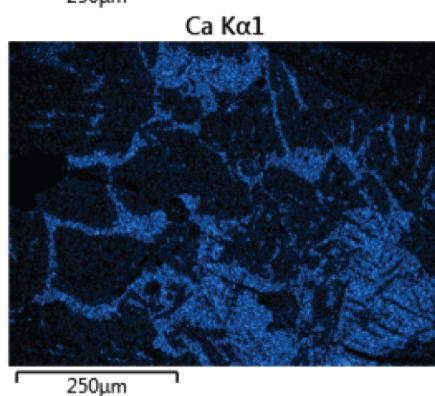
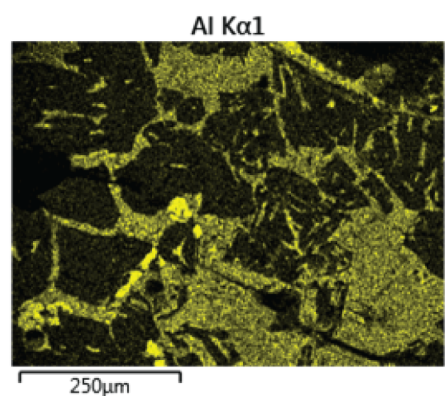
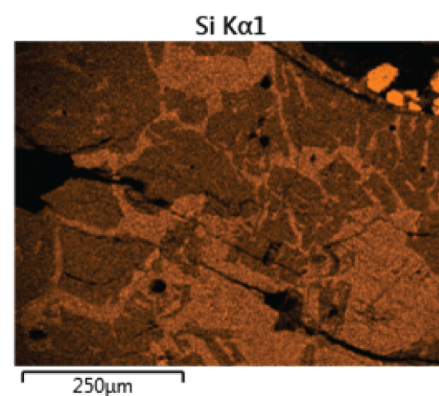
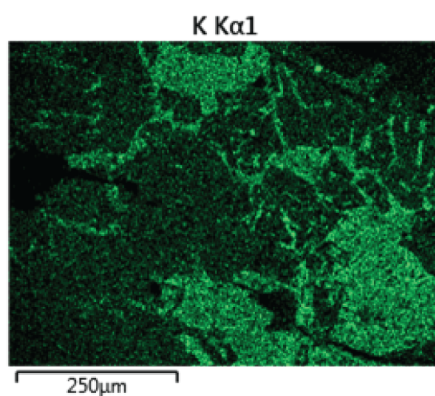
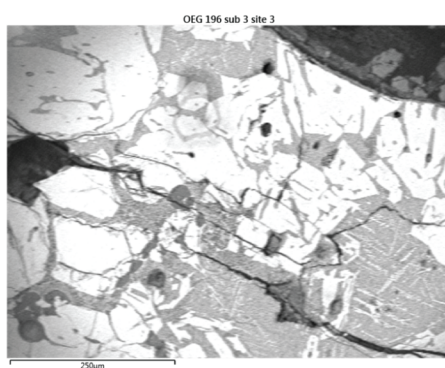
OEG 196 sub 3



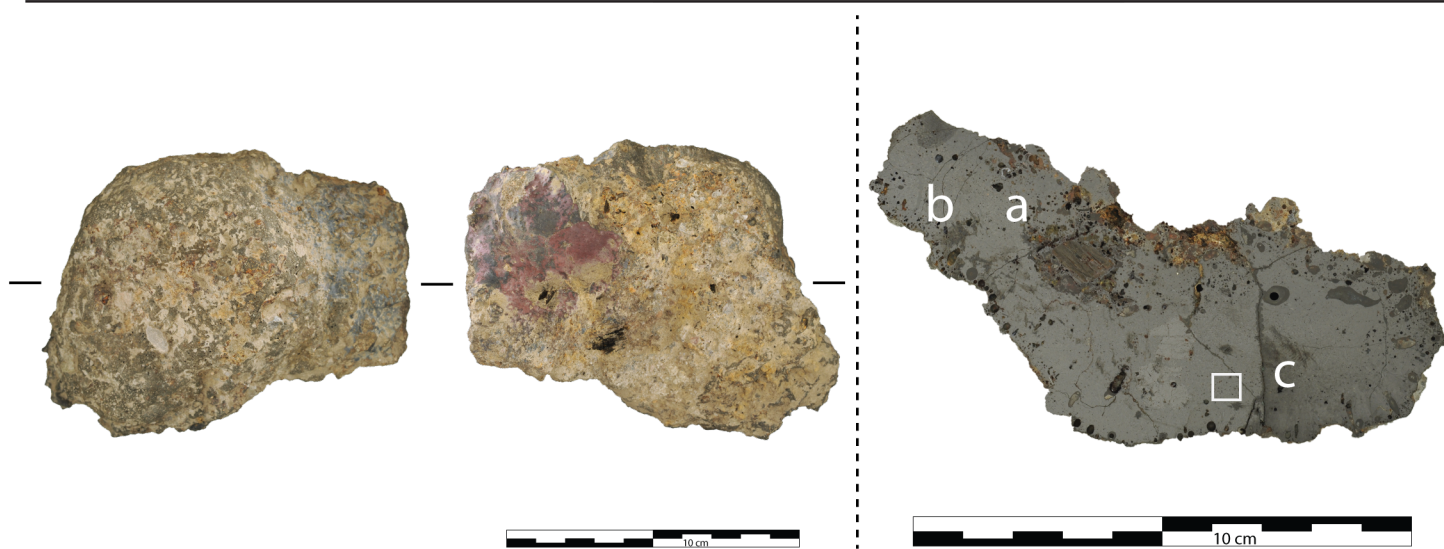
Small section of mostly SGD (a) hearth bottoms with several veins of SAS (b, c) running through it. Mineral content is mostly fayalite, wusite and spinels (centre SGD band). Contained a large piece of corroded iron (c).



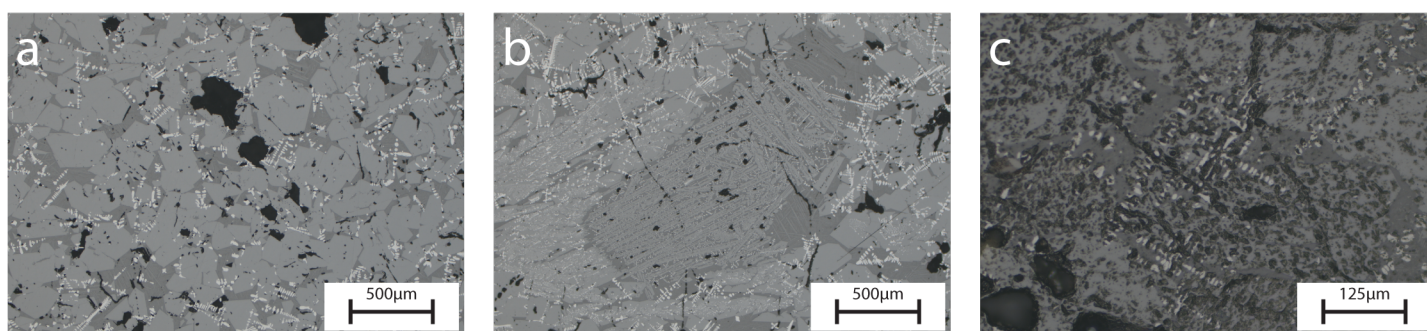
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	27.4	1.51	0.35	2.61	20.11	0.15	0.07	0.02	1.03	3.65	0.14	0	0.08	0	42.48	0.39
wt% σ	0.1	0.03	0.01	0.02	0.04	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.08	0.07



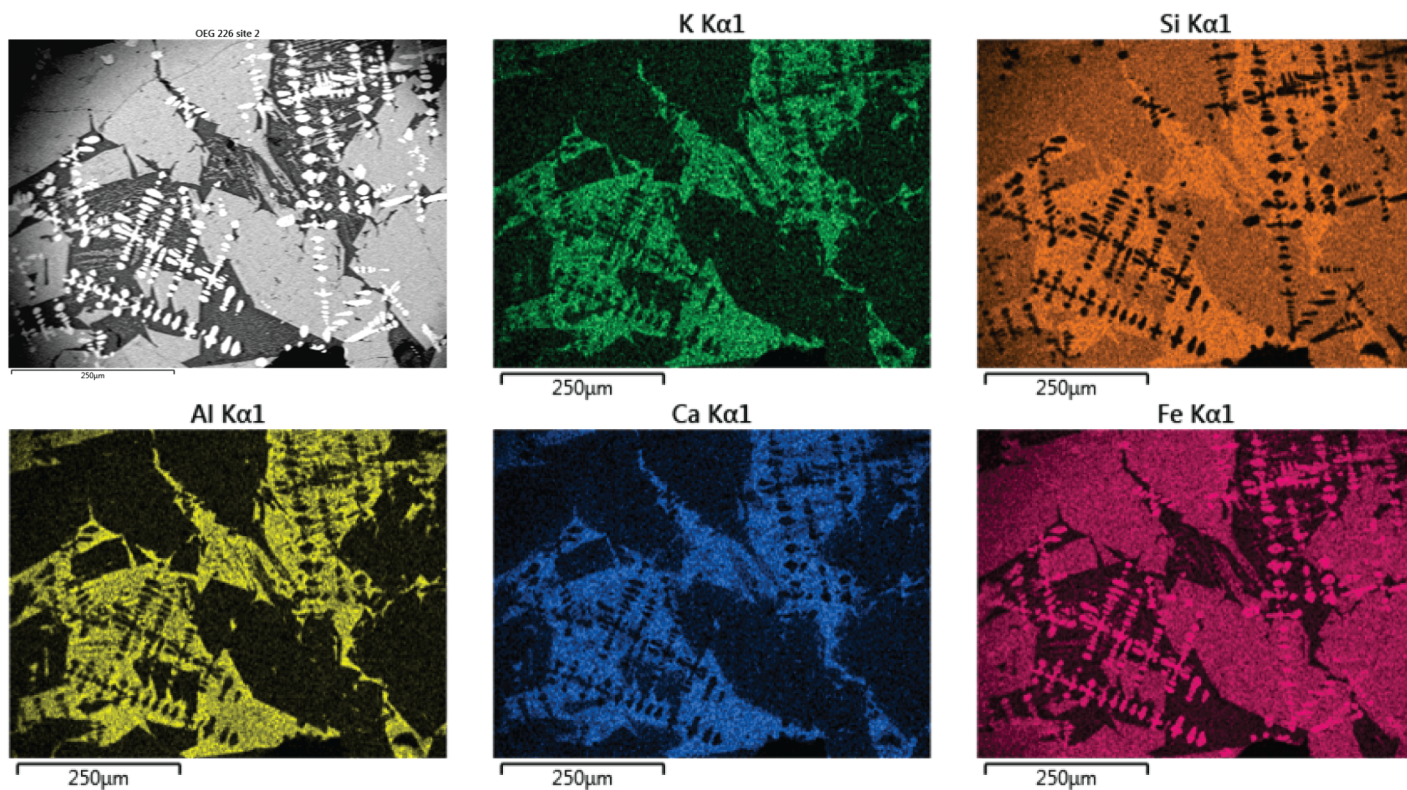
OEG 226



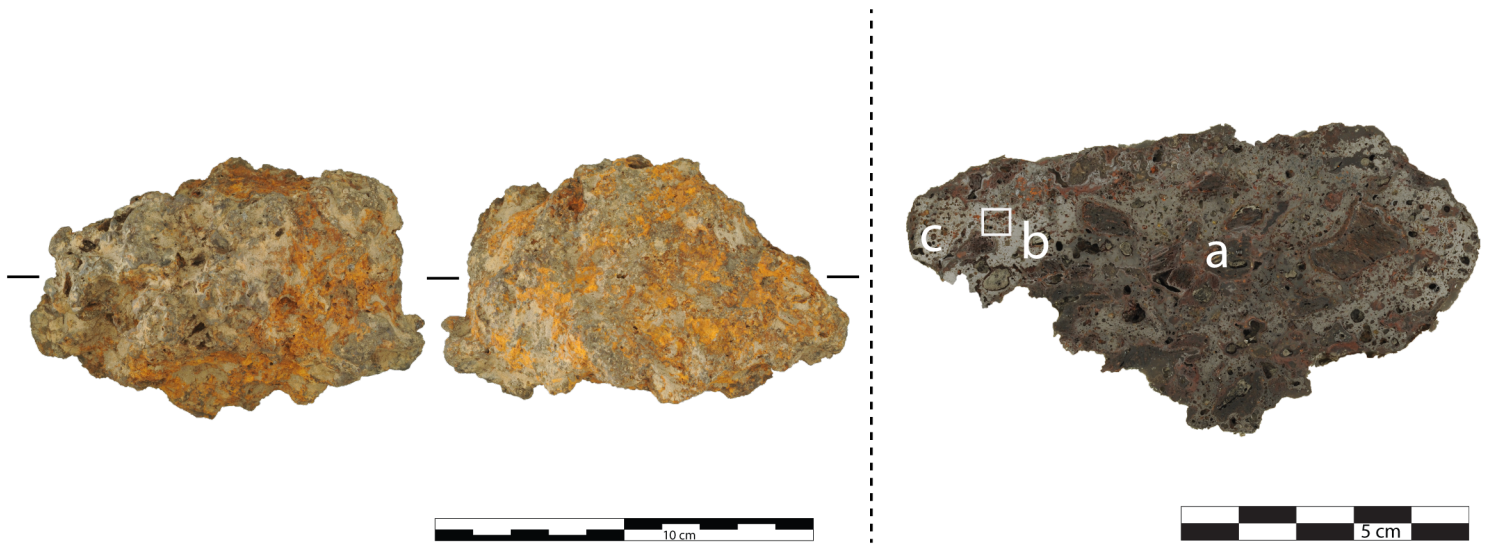
Large piece of slag with a large outcrop from the tuyère. This outcrop was covered in a reddish oxide layer. SGD/SCD, entirely fayalite and wüstite (a,b) with charcoal impressions (c) and inclusions.



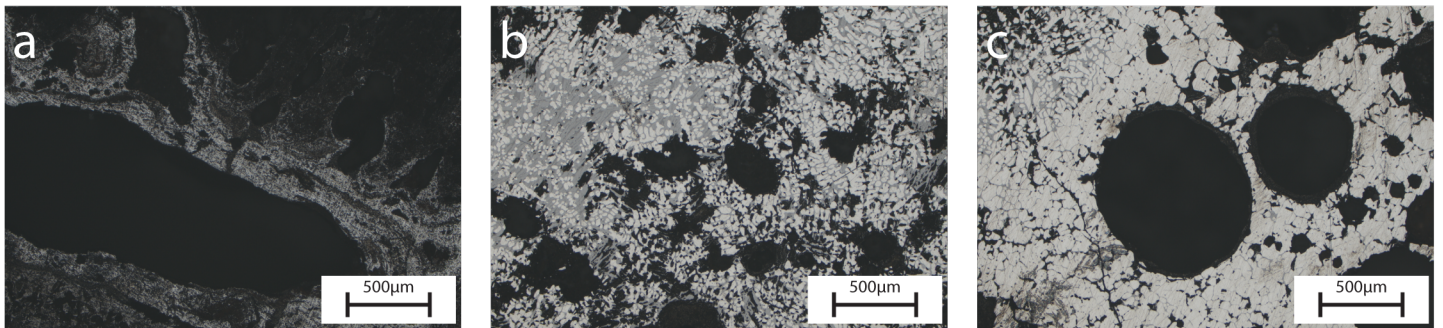
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	25.62	1.17	0.11	3.95	15.21	0.22	0.07	0	1.48	3.14	0.15	0	0.09	0.11	47.78	0.62
wt% σ	0.08	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.08	0.07



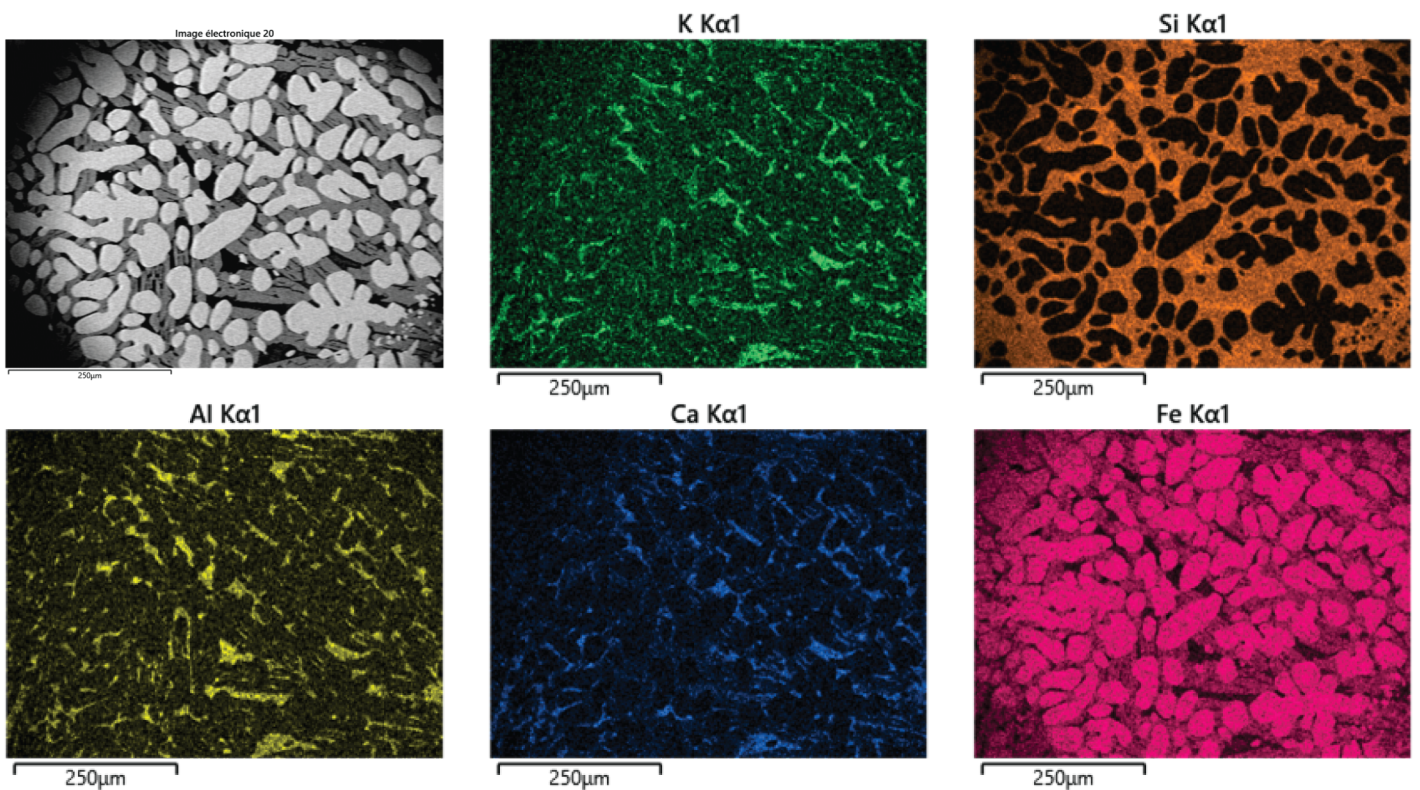
OEG 283A



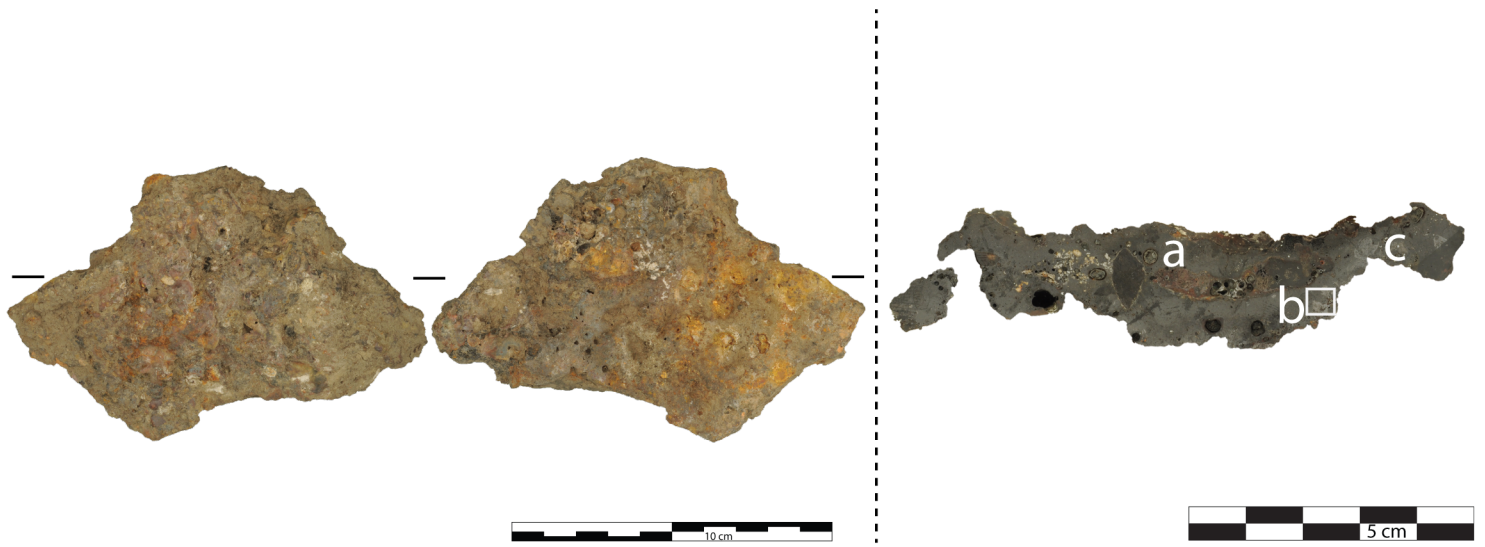
Large SFR hearth bottom with many charcoal inclusions (a) and charcoal impressions. Mineral structure is made of fayalite and mostly globular wüstite (b, c).



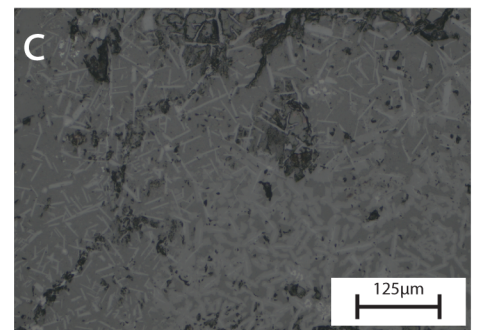
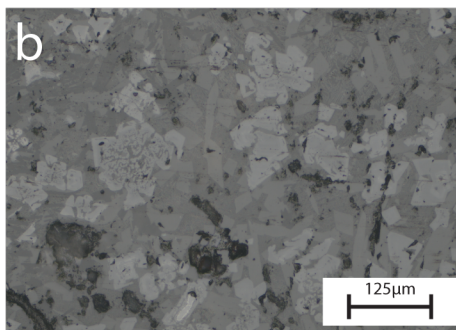
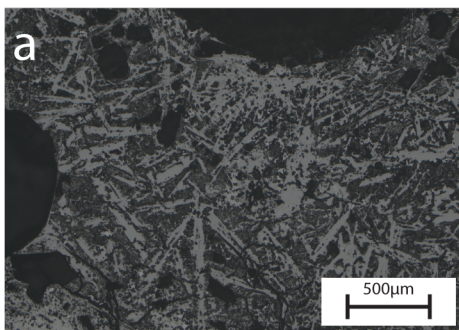
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	21.55	0.53	0.21	1.06	7.83	0.53	0.06	0	0.56	1.3	0.05	0	0.04	0	65.98	0.3
wt% σ	0.07	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.05	0.02	0.02	0.02	0.02	0.09	0.08



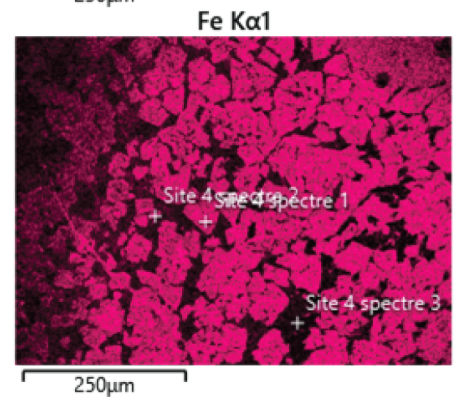
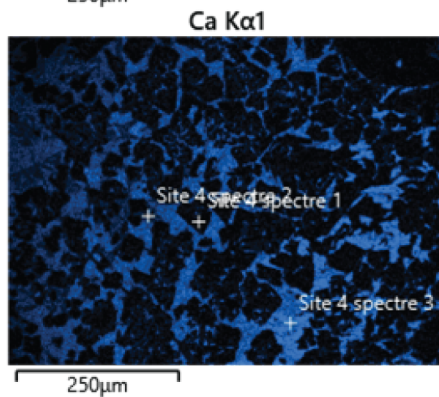
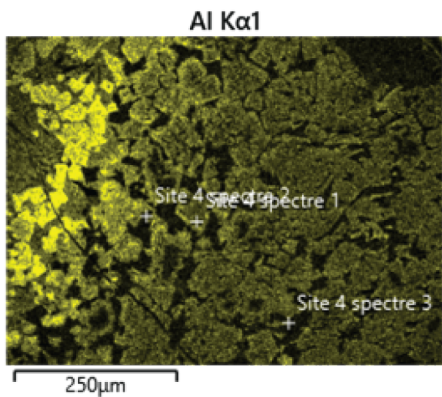
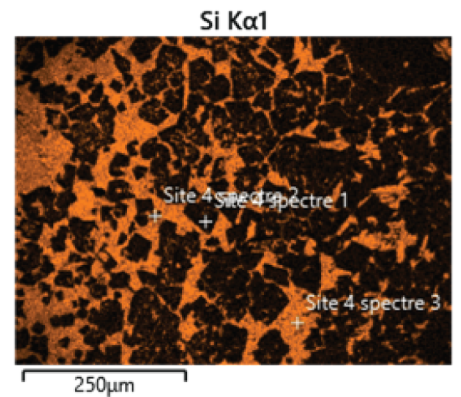
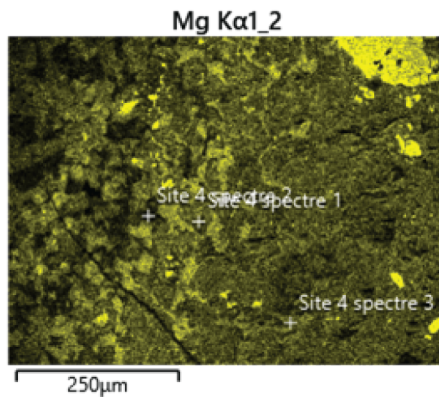
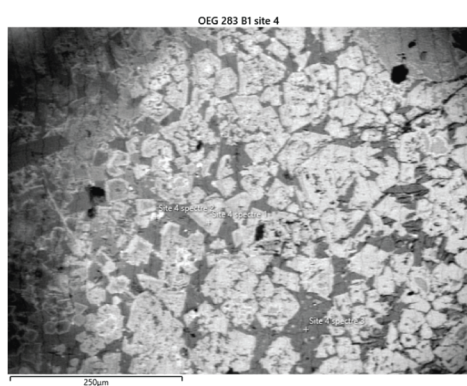
OEG 283B



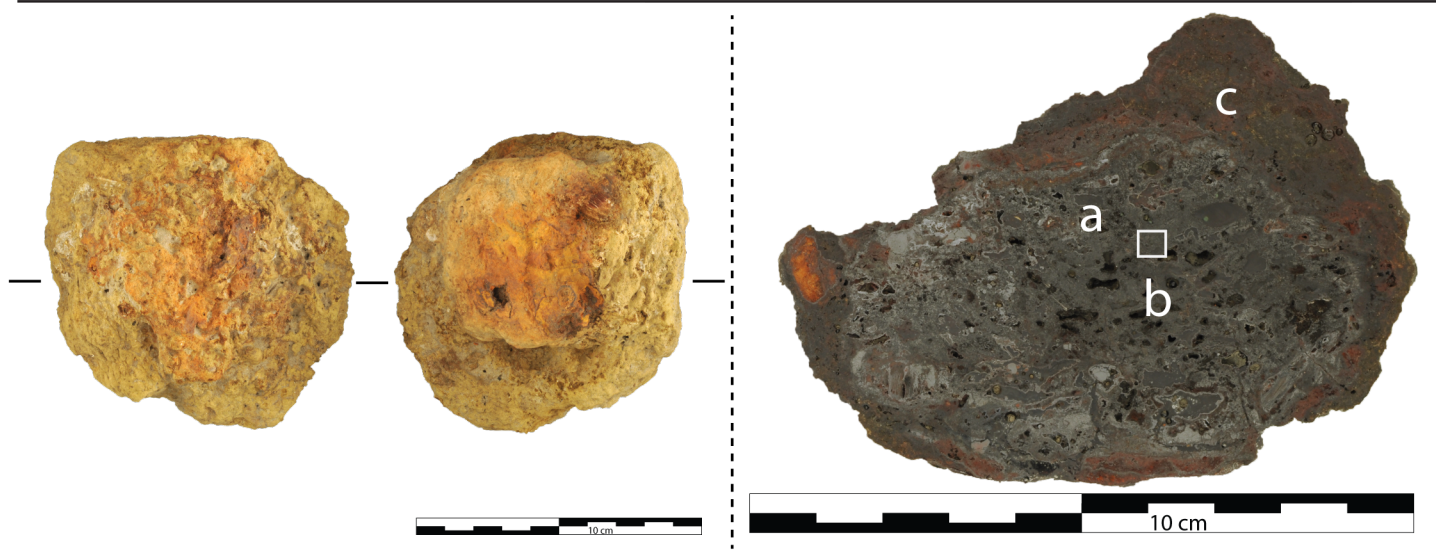
Large flat SGD/SCD hearth bottom. Large charcoal inclusion and unusual yellow crystals to one end. Mineral structure mostly fayalite but no wustite (a) with some magnetite (b) and another spinel (c).



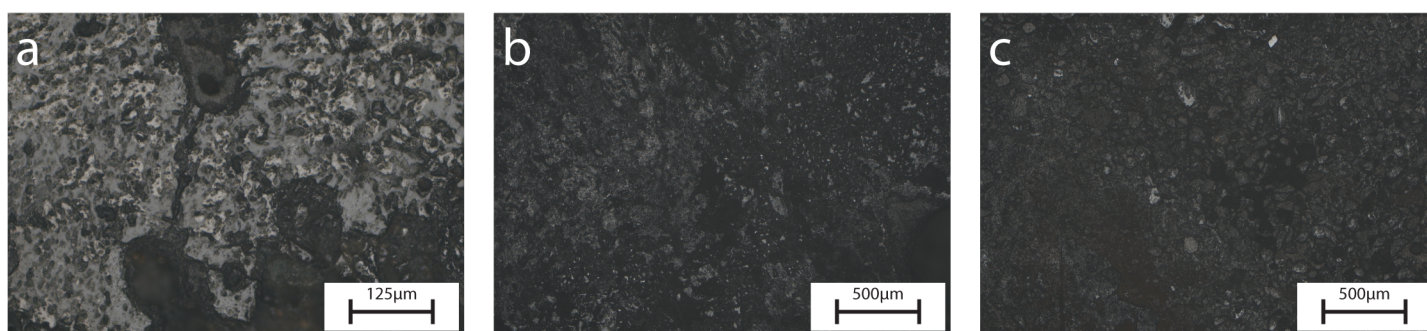
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	25.75	0.34	7.08	7.73	7.73	0.24	0.6	0	0.33	7.86	0.34	0	0.03	0.32	40.99	0.34
wt% σ	0.09	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.03	0.02	0.02	0.02	0.03	0.08	0.07



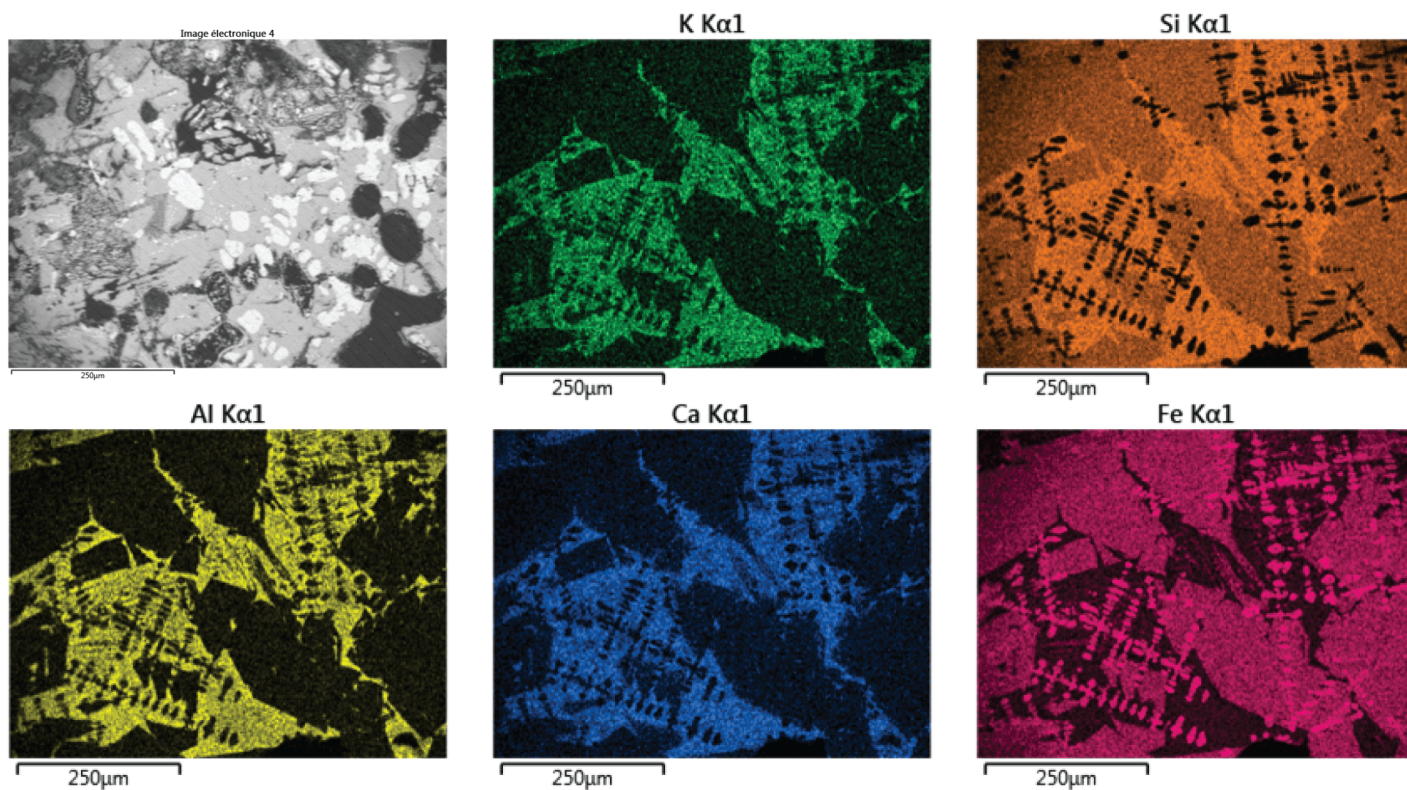
OEG 603



Large piece of SFR covered in sediment. Optical microscopy revealed several large corroded copper prills (a, SEM secondary electron image). SEM-EDX also found an unusually high Mn content (up to 15 wt%).



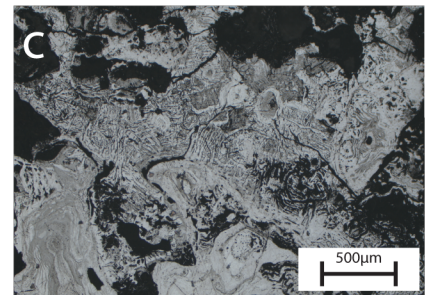
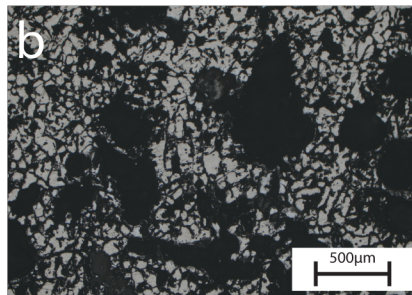
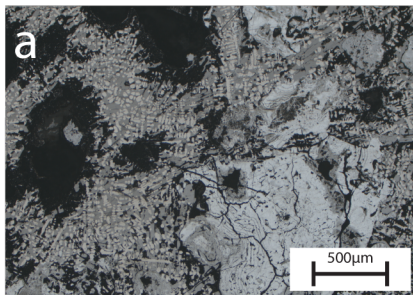
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	20.45	0.52	1.36	1.51	10.99	0.03	0.14	0.42	0.29	0.94	0.08	0	0.04	11.28	52.04	0.91
wt% σ	0.08	0.03	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.05	0.09	0.08



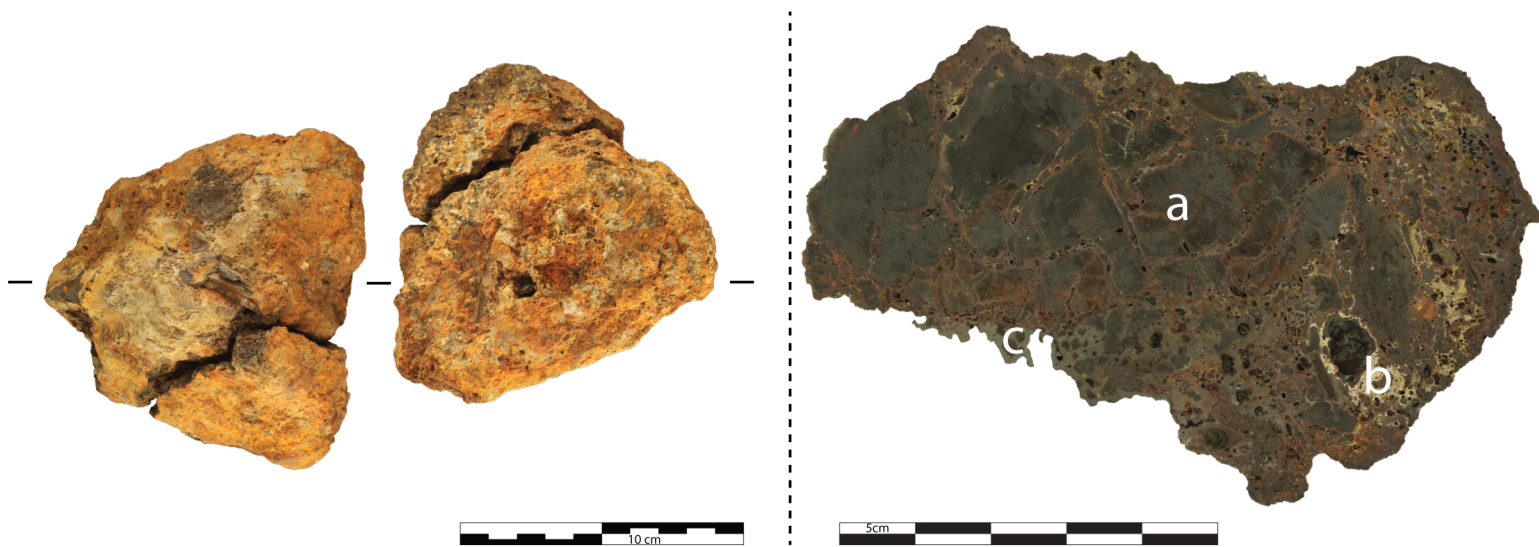
OEG 662



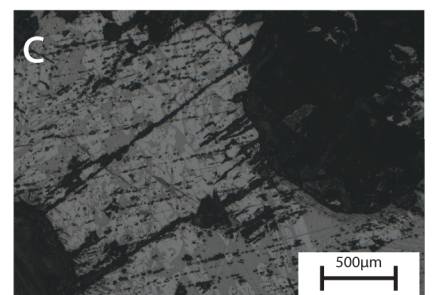
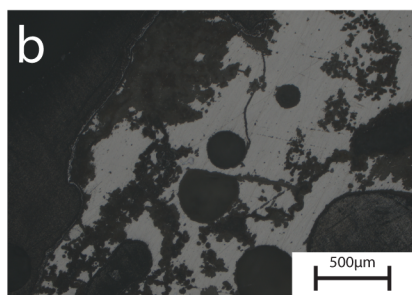
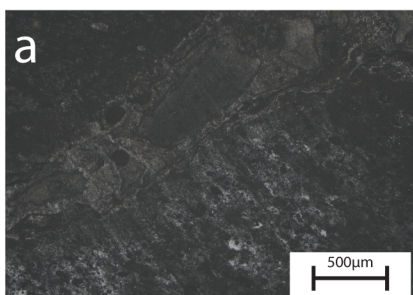
SFR hearth bottom. The microstructure is comprised of fayalite (a), wüstite dendrites (a) and globules (b) as well as corrosion product (c). Some charcoal impressions in the centre (b).



OEG 727



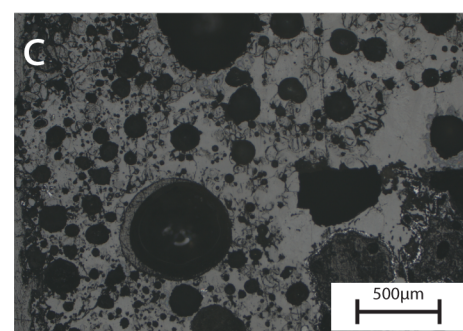
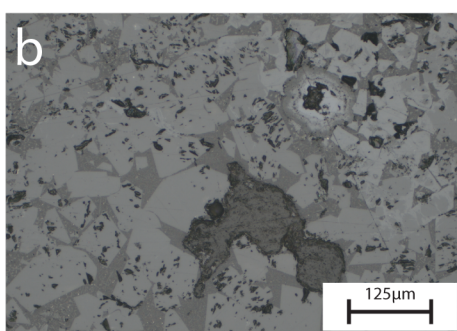
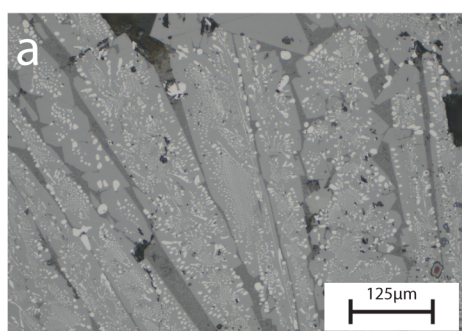
Large hearth bottom with a large number of charcoal inclusions (a). The facies is predominantly SAS with some yellow glass at the right end (b) with some SGD with charcoal impressions in the base (c).



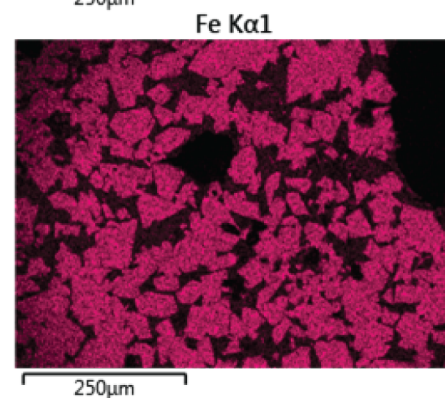
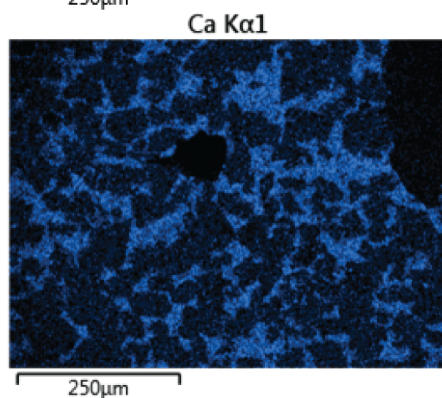
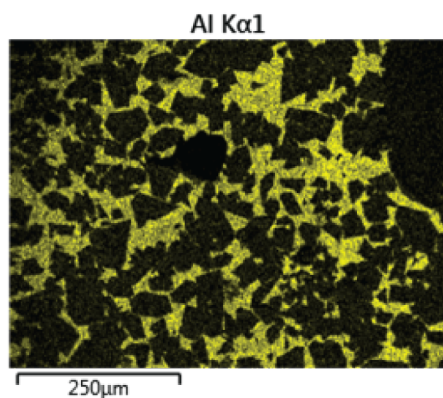
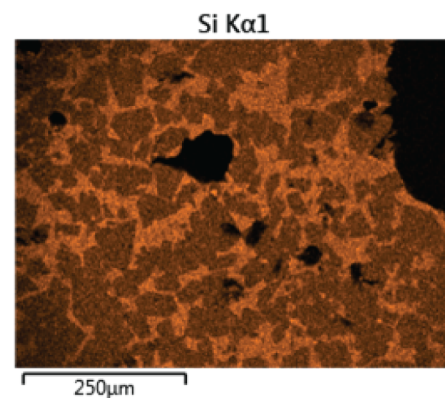
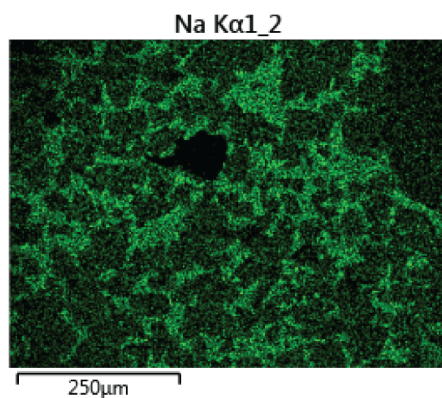
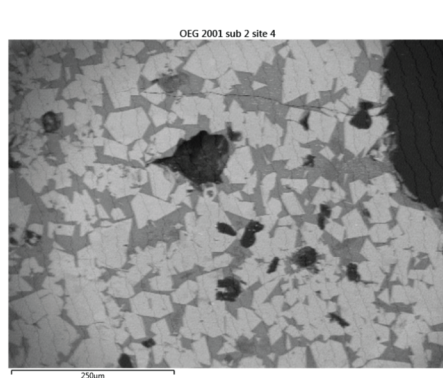
OEG 2001 sub 2



Large piece with an unusually clear impression from the hearth. Mostly SGD/SCD (a/b) in the base with a large cavity in the centre surrounded by SAS (c) and an SFR upper section. Some charcoal inclusions.



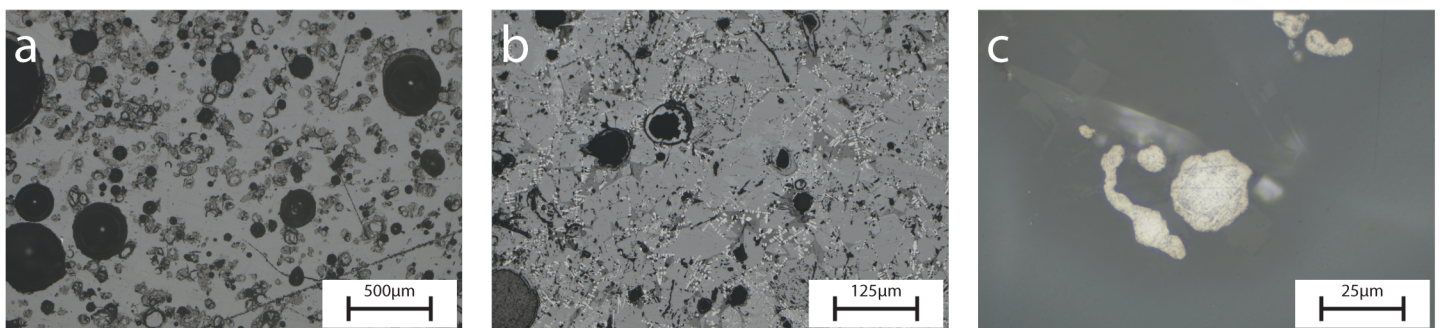
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	22.35	1.23	0.27	3.29	19.07	0.29	0.13	0.21	1.43	2.13	0.22	0	0.09	0.39	48.41	0.49
wt% σ	0.1	0.03	0.02	0.02	0.04	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.09	0.07



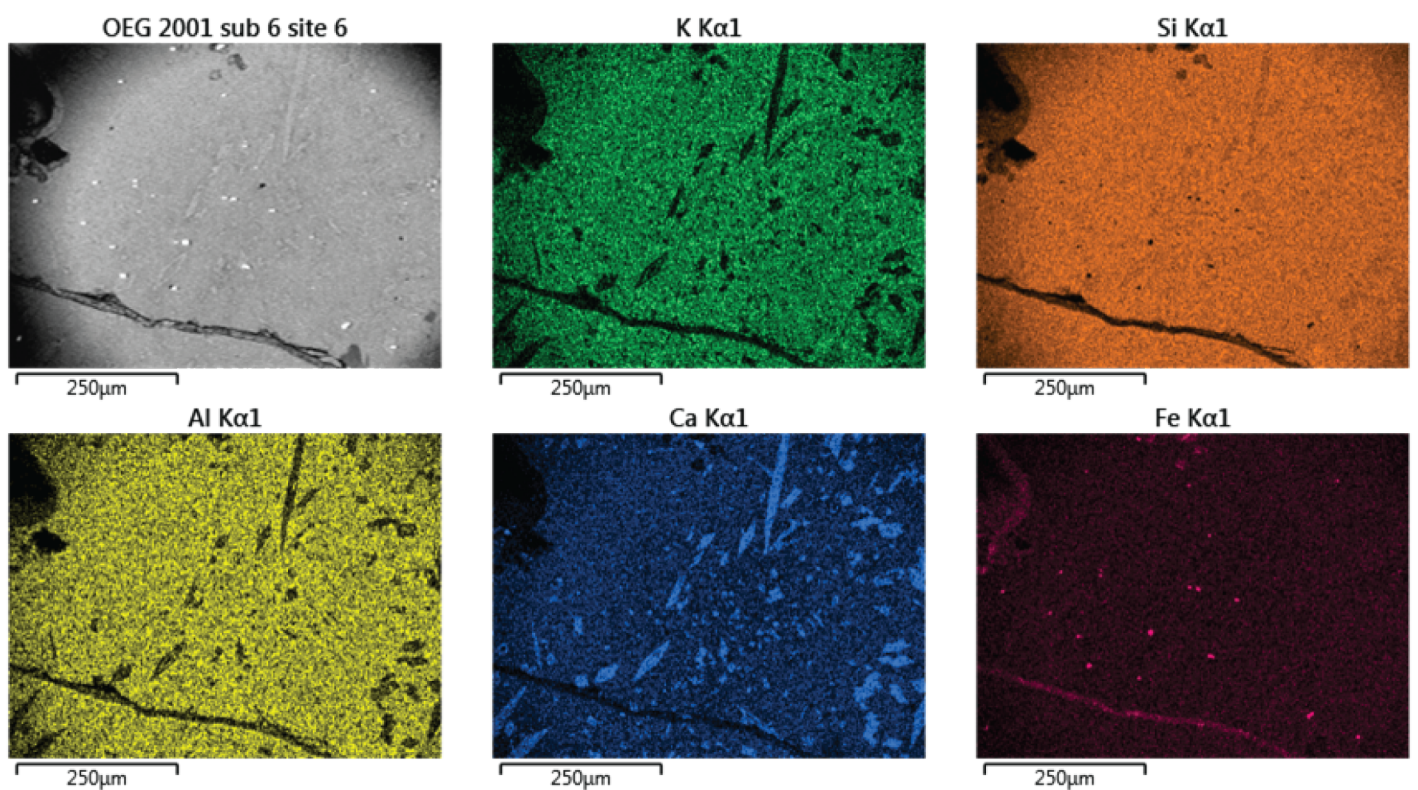
OEG 2001 sub 6



Double hearth bottom retaining the rough shape of the hearth and tuèyre. Mostly SAS (a) with a small section of SGD at one end (b). Very little visible mineral structure but does contain some iron prills (c).



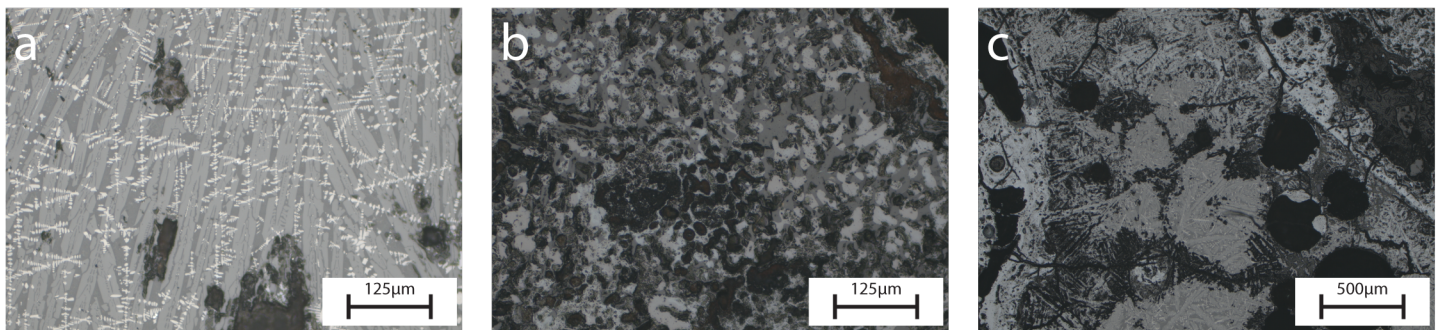
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	36.31	2.43	1.25	3.07	30.17	0.83	0.05	0	4.32	6.06	0.24	0	0	0.18	14.86	0.23
wt% σ	0.1	0.02	0.01	0.02	0.06	0.02	0.01	0.01	0.02	0.03	0.02	0.02	0.02	0.02	0.06	0.06



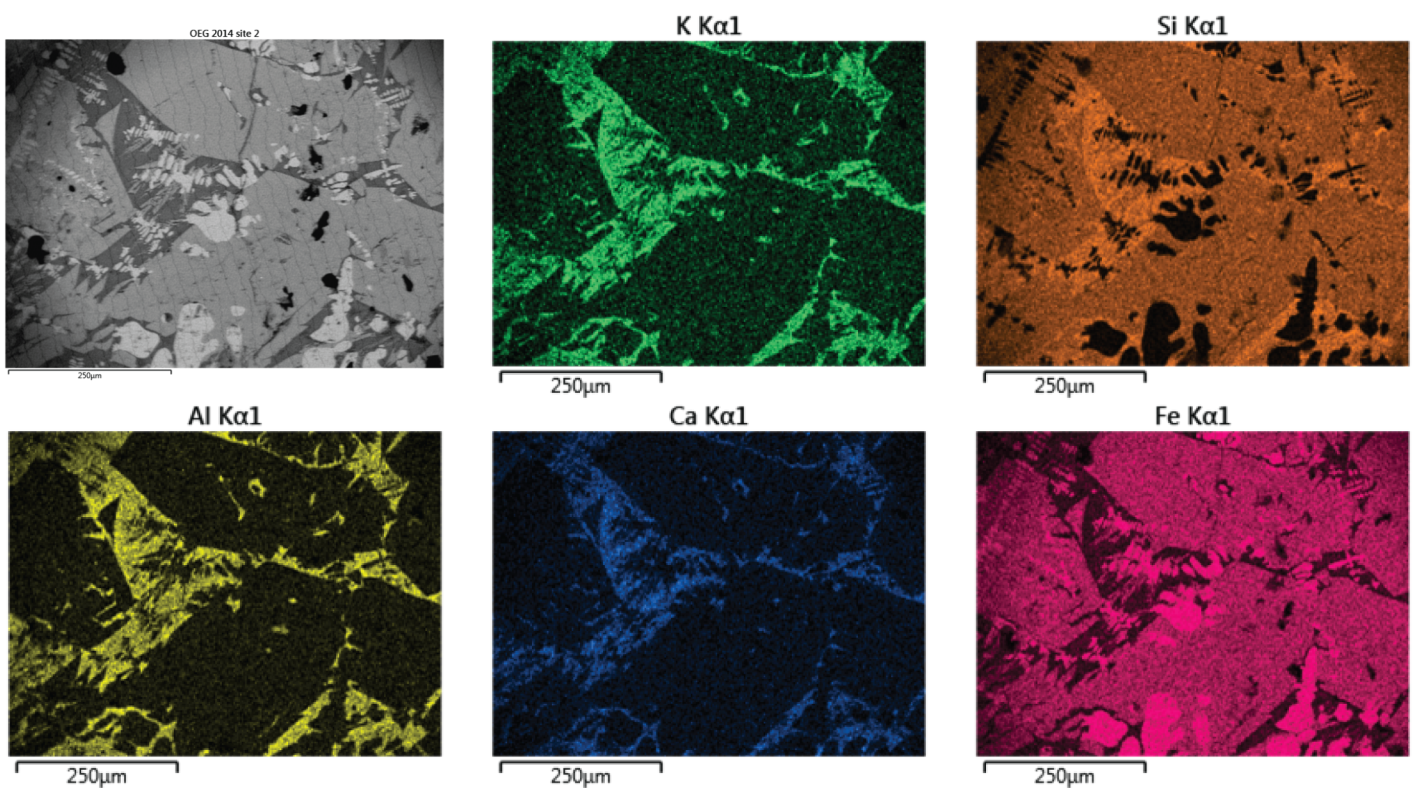
OEG 2011A



Small SFR hearth bottom. Mostly fayalite and dendritic wüstite (a). Many charcoal impressions (a, b) and corrosion product (c).



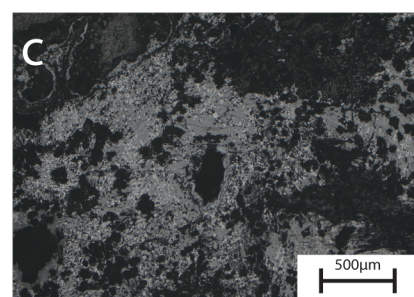
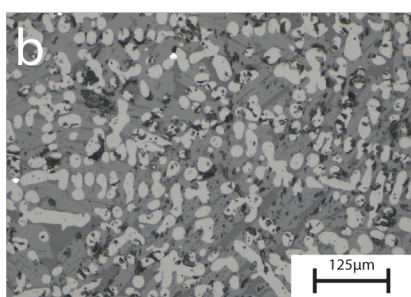
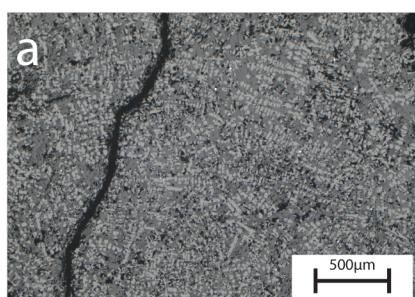
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	21.15	0.9	0.42	1.9	13.96	0.44	0.08	0.08	1.12	1.5	0.05	0	0	0	57.97	0.42
wt% σ	0.08	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.08	0.06



OEG 2011B



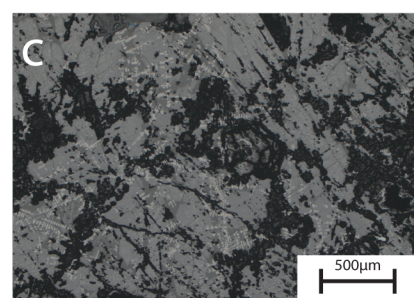
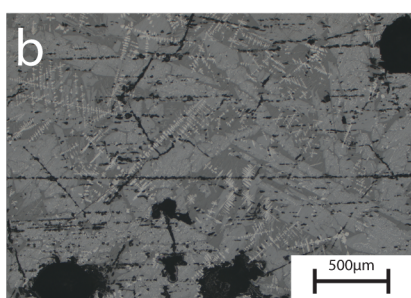
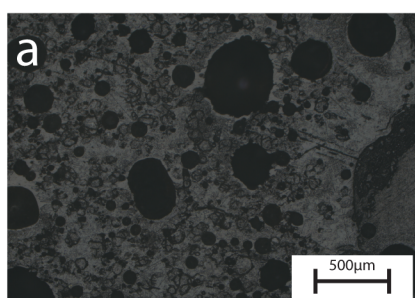
Amorphous SFR. Mineral structure made of fayalite, dendritic wustite and small iron prills (a, b). No charcoal inclusions but frequent charcoal impressions and some corrosion product (c).



OEG 2487

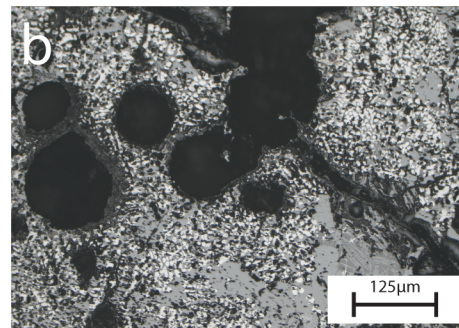
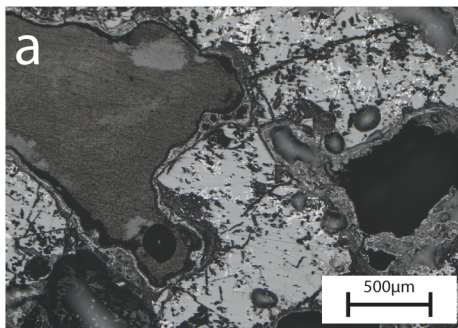


SCD/SFR with some glassy phases (a). The hearth bottom had a very large hole in the centre and several large charcoal inclusions. Mostly fayalite and dendritic wustite with frequent charcoal impressions (b, c).

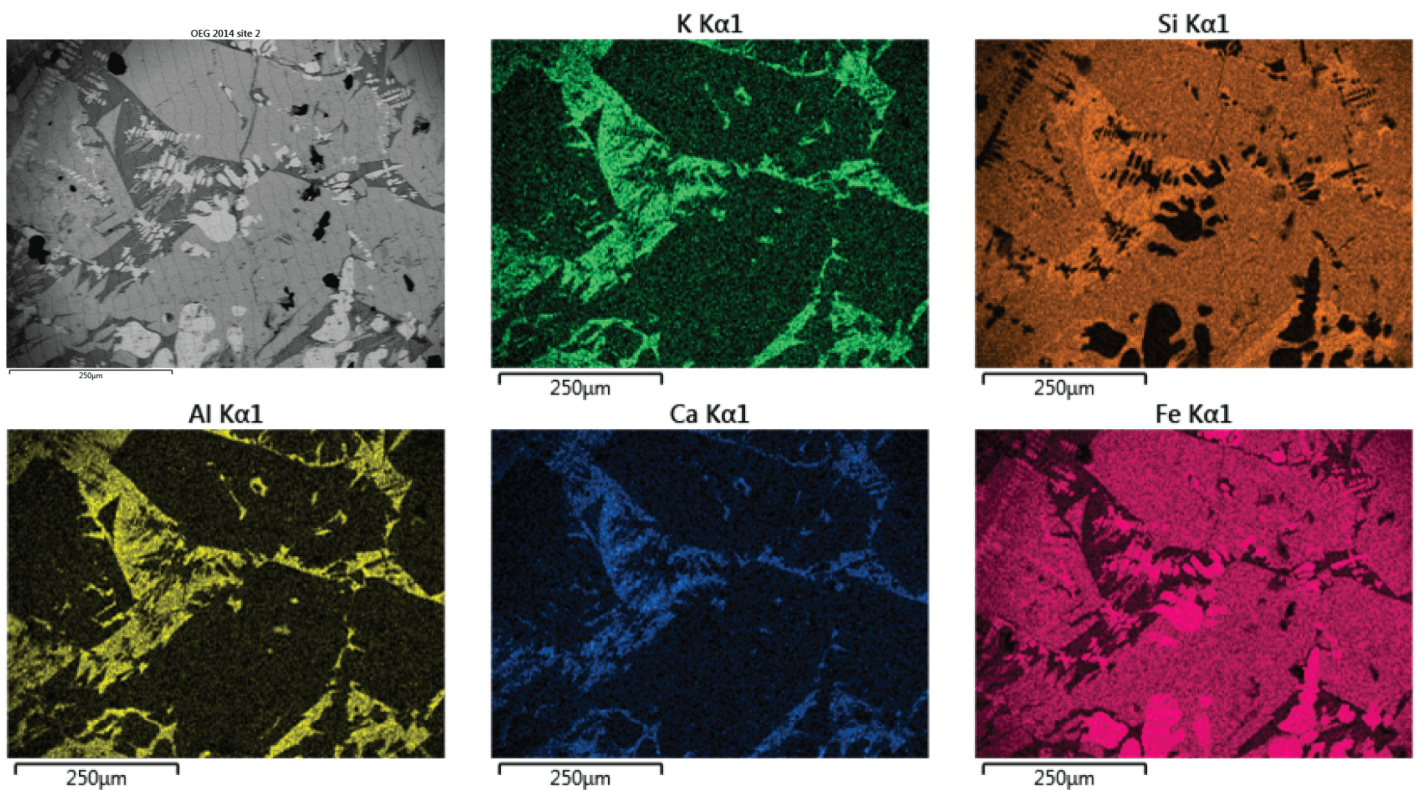




SFR, likely a double hearth bottom. Microstructure was entirely fayalite and dendritic wüstite (a, b) with charcoal inclusions, impressions and corrosion product.



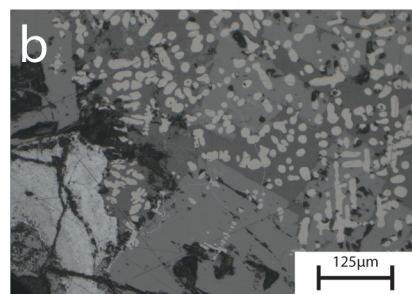
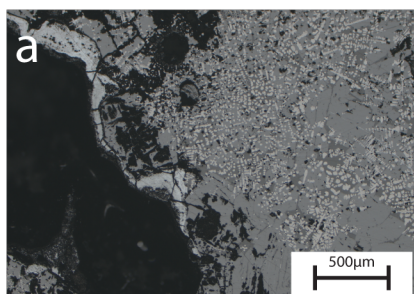
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	21.15	0.9	0.42	1.9	13.96	0.44	0.08	0.08	1.12	1.5	0.05	0	0	0	57.97	0.42
wt% σ	0.08	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.08	0.06



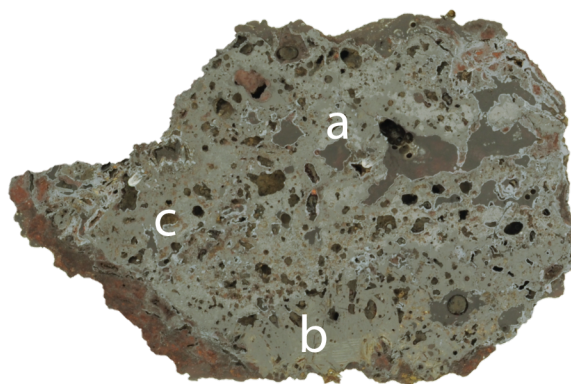
OEG 2526



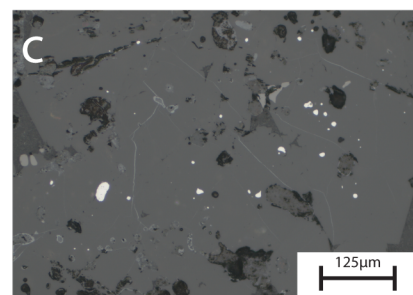
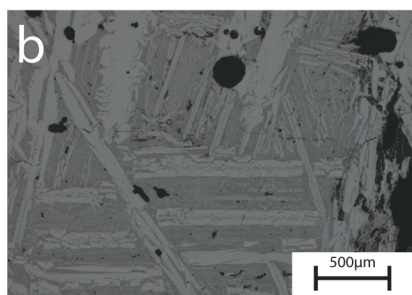
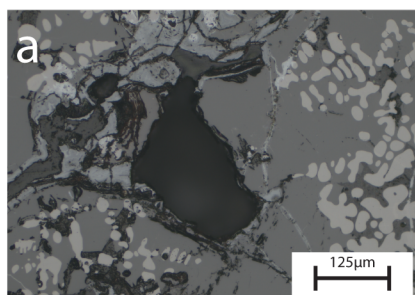
SFR hearth bottom. Mostly fayalite and wüstite with some corrosion product (a, b).



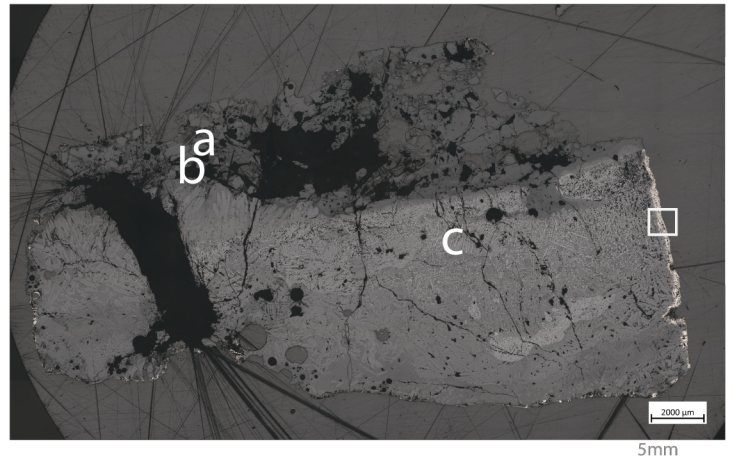
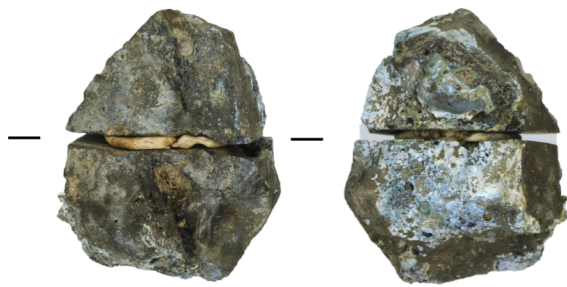
OEG 3156A



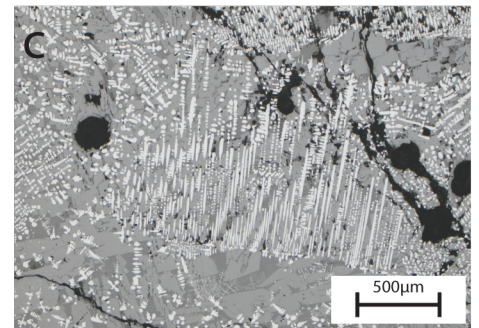
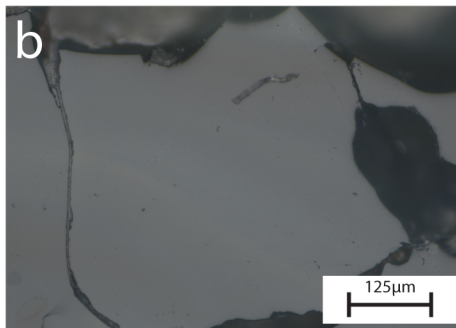
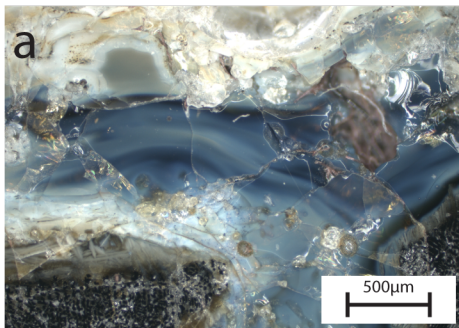
SFR hearth bottom. The microstructure is comprised of fayalite (a, b), globular wüstite (a) and corrosion product (a, b). Some iron prills (c)



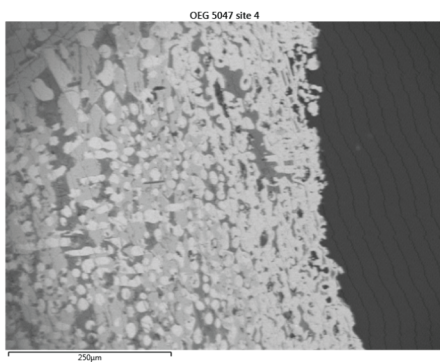
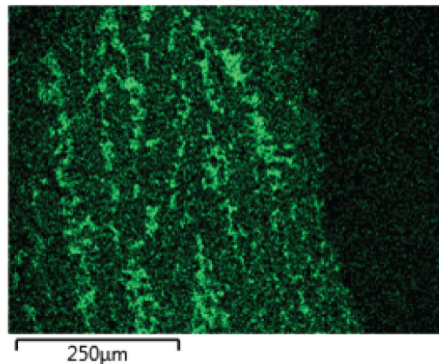
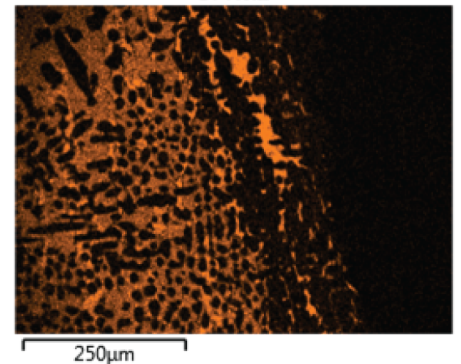
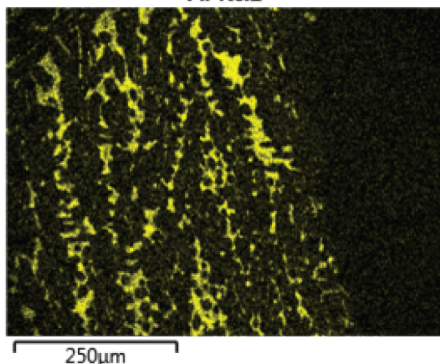
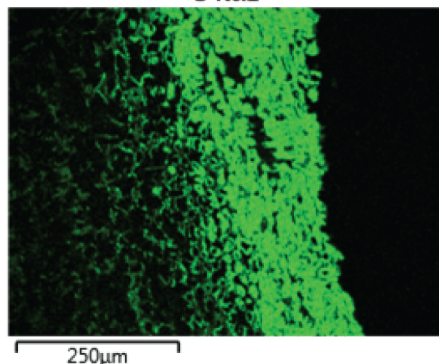
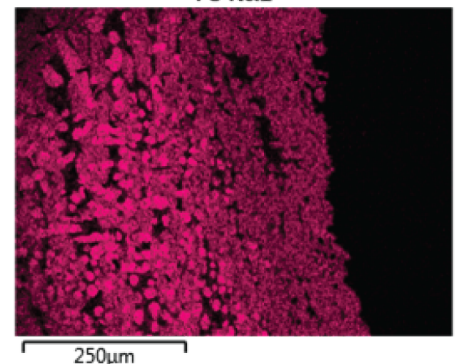
OEG 5047



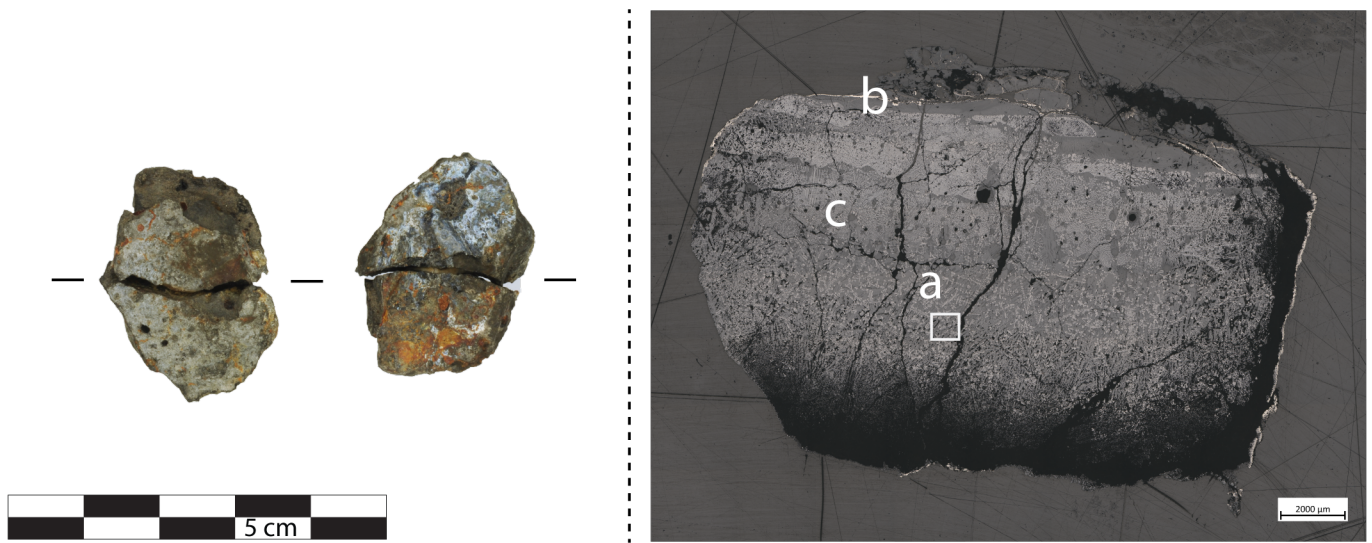
Small piece of amorphous slag, selected for the unusual blue colour on its surface. Similar to OEG 5052, clear stratigraphy: glassy upper section (a, b) and SGD lower section (c). Sulphur rich deposit on surface.



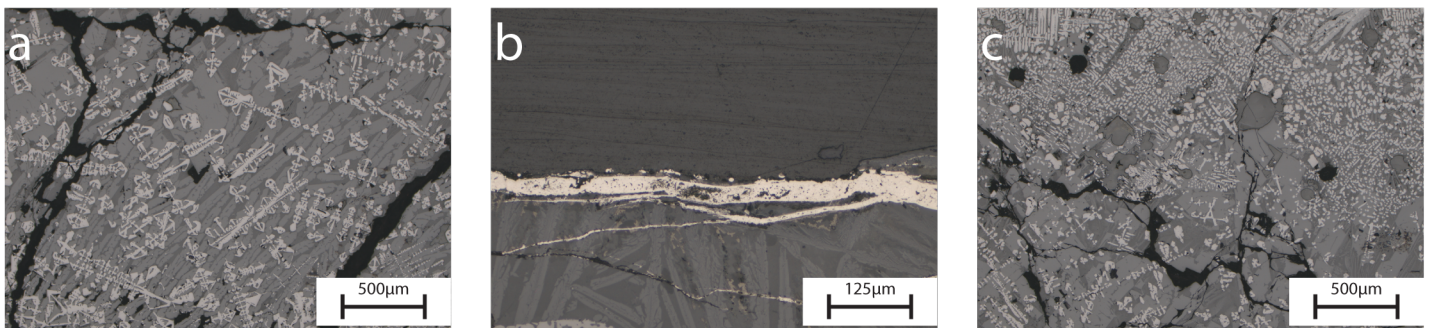
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	9.01	0.95	0	1.19	2.76	0	43.38	0	0.51	0.67	0	0.08	0.05	0.98	41.02	0
wt% σ	0.1	0.02	0.01	0.01	0.02	0.01	0.07	0.02	0.01	0.01	0.02	0.02	0.02	0.03	0.07	0.07

K K α 1Si K α 1Al K α 1S K α 1Fe K α 1

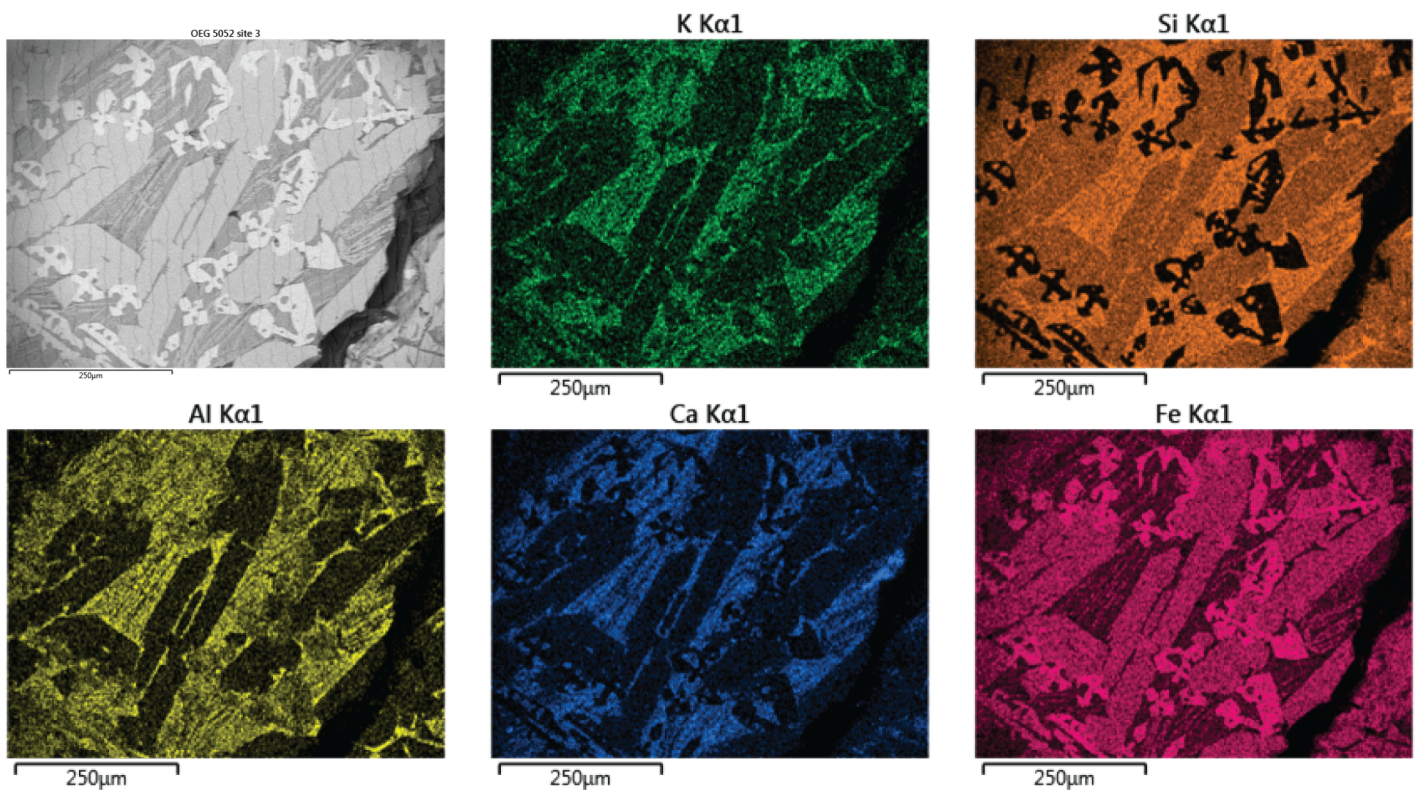
OEG 5052



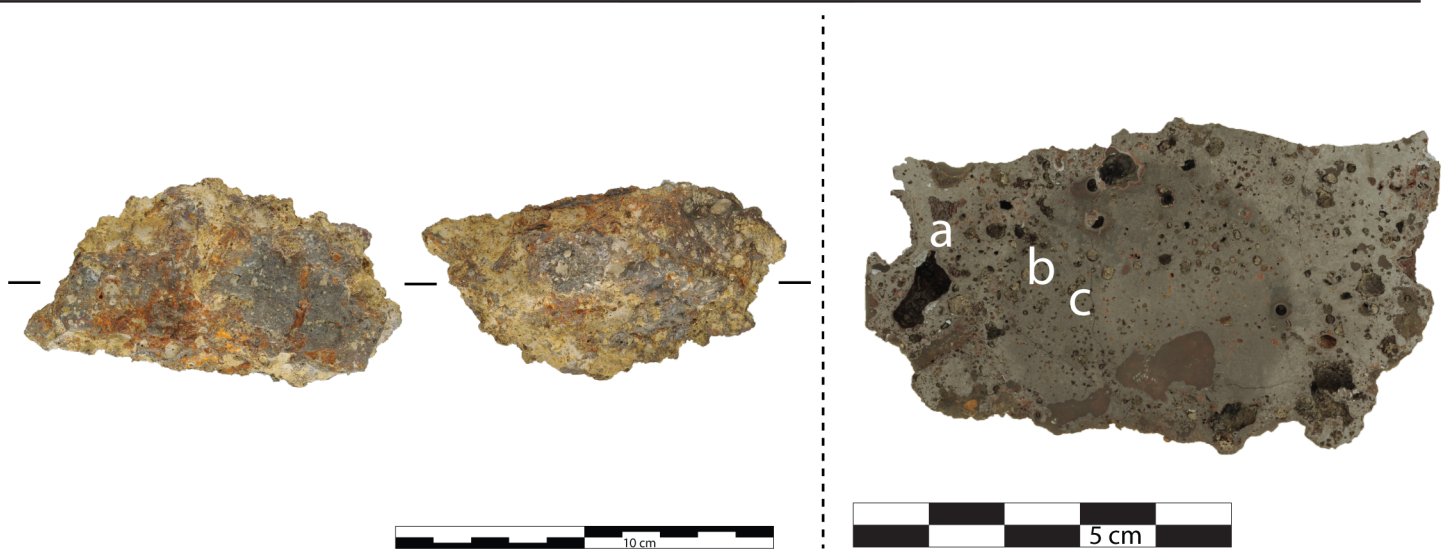
Small piece of amorphous slag, selected for the unusual blue colour on its surface. Similar to OEG 5047, with the same microstructure sulphur rich deposit on the surface (a). Rare example of euhedral wüstite (b).



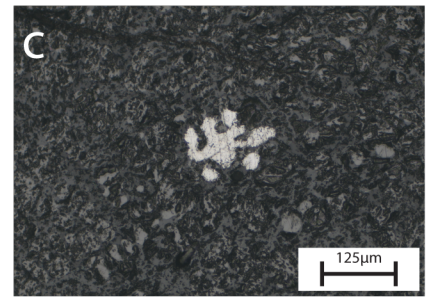
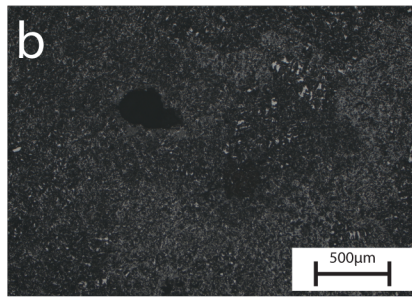
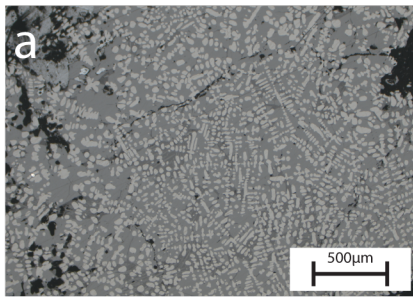
Element	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Cu
wt%	26.65	0.78	0.47	2.12	14.63	0.15	0.05	0	1.02	3.21	0.19	0	0.05	0.07	50.08	0.55
wt% σ	0.1	0.03	0.02	0.02	0.04	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.1	0.08



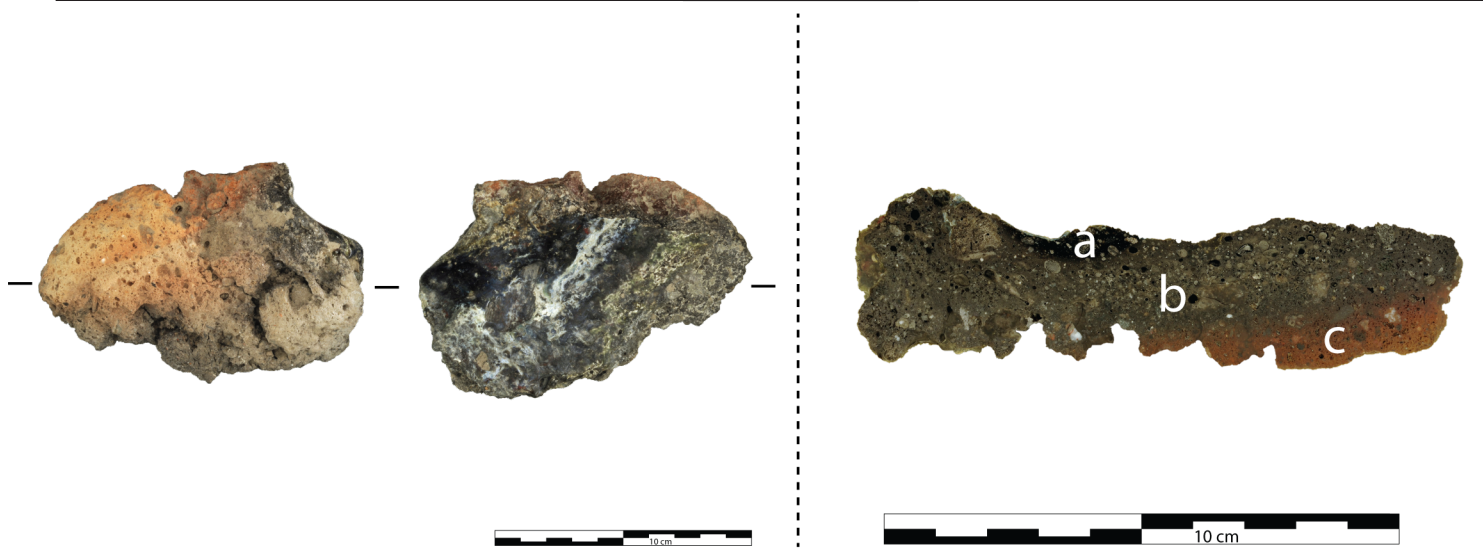
OEG 5161



SGD hearth bottom. The microstructure is comprised of fayalite (a). Wüstite dendrites (a). Large charcoal impression in the centre (b, c) though few charcoal inclusions. Some iron prills (c)



OEG 5763



Large piece of vitrified hearth lining, given the diveted, tube like shape most likely part of a tuyère. Blue/white glass on the surface (a) with a glassy interior (b) and clay-like exterior (c).

