

KEELOGE

Background information

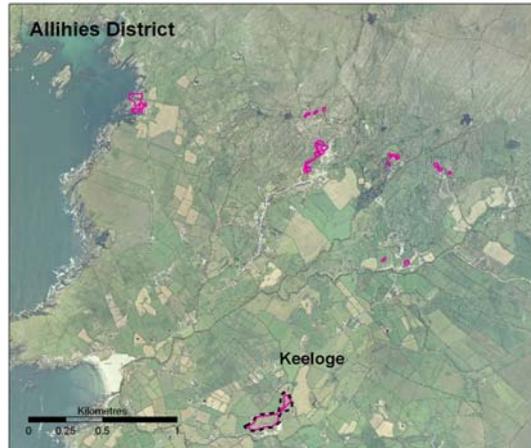
Mine District: Allihies

Mine Name: Keeloge

Alternative Names:
Kealoge, Kealogue, Keallogue

Elements of interest:
Cu

Project Prefix: ALL-



County:
Cork

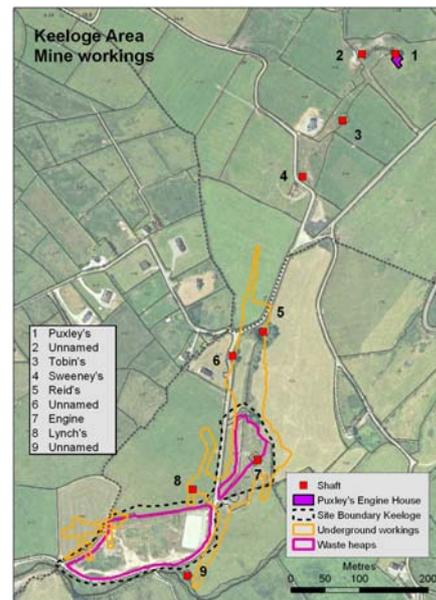
Townland:
Cahermeeleboe

Grid Reference:
E58648, N43822

Site Description and Environmental Setting

The Keeloge mine lies at the southern end of the Allihies district. It includes the mine workings on the southern half of the 2km-long Caminches lode (right). For this project, only the southern end of the site, around the processing area and engine shaft, was studied in detail. This part of the site can be divided into two parts: to the east of the public road is the engine shaft and associated buildings and waste heaps, to the west is the old processing area (Fig. 1).

Keeloge was the site of extensive and deep workings. According to Smyth, quoted in Cole (1922), it was a "very rich" mine. The depth of the workings, reaching 460m on the 240fm level below the engine shaft and 410m below Reed's shaft (right), rivals that of Mountain Mine. The



associated processing area, as drawn on old mine plans, with three stamp batteries and large separation tanks (buddles) (Fig. 1), testifies to a considerable level of activity on the site. However, only limited reminders of this activity remain. There are several shafts, all fenced, including the engine shaft and Reed's shaft. Puxley's engine house (left) is a well-preserved structure at the northern extremity of the Keeloge workings. The engine shaft is surrounded by an extensive bank of spoil, including slag. An outdoor equestrian arena covers the eastern part of the

processing site while fly-tipping of soil and building waste has obscured much of the rest. The grassed-over low walls of the ruined counting house provide some orientation on the processing area site. A cobbled floor is discernible here and pockets of mine waste, including Fe-oxidized stamps waste, are visible. A grassy area on the northern side is used as pasture. The area containing the engine house is private land and is fenced off. It is periodically in use as cattle pasture. Ownership of the area of the processing site is unclear: it is for the most part unfenced and has been in use as a dumping ground for some time. Seepage from the processing area drains via a small culvert to the Keeloge River, which runs past the southern boundary of the site.

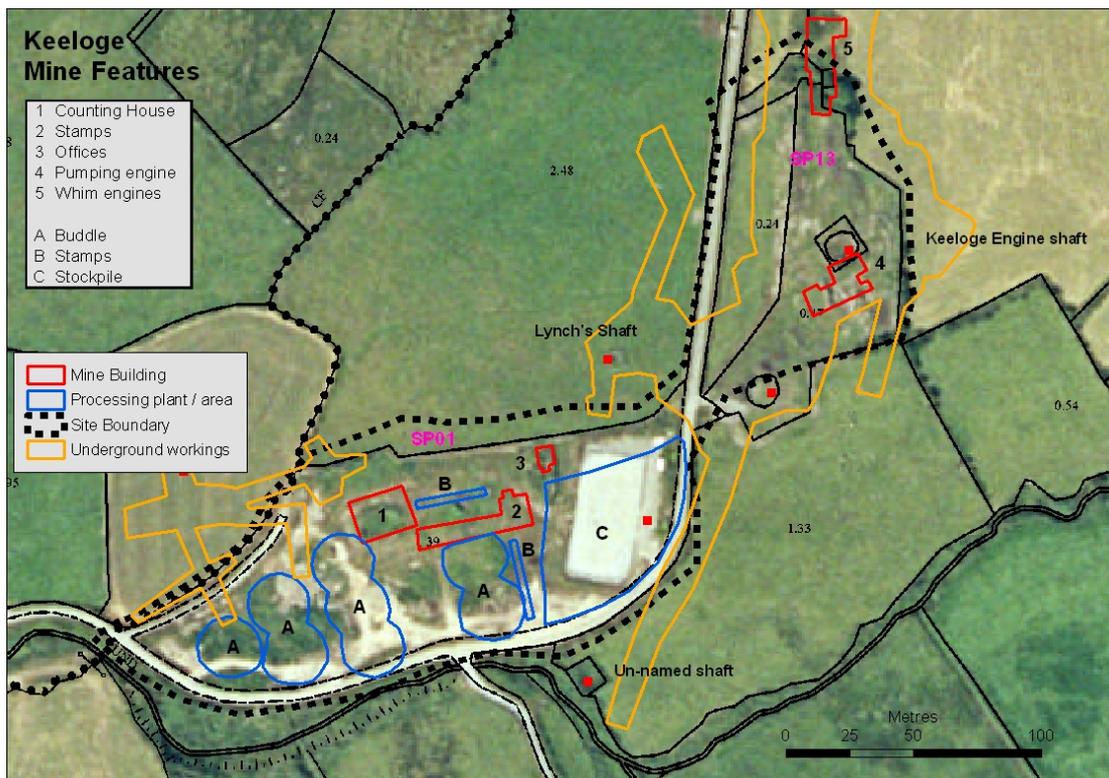


Fig. 1 Keeloge: extant and historic mine features

Table 1 Area and Volume of spoil heaps, Keeloge

Waste ID	Area (m ²)	Volume (m ³)
ALL-08-SP01	13199	13199
ALL-08-SP13	3011	2807

Geochemical Assessment

1. Surface Water

The Keeloge River was sampled both upstream and downstream of the processing area site in winter and summer (see Allihies District report). There was a small seepage from the processing area during the winter sampling period but none in summer. The pH is slightly alkaline (7.3 - 7.5) for all samples and the EC low (c. 0.2 – 0.25 mS/cm). Total Cu concentrations in river water range from 14 µg/l to 51 µg/l, with downstream values higher in each sampling period. Measured concentration of

Cu(tot) in the winter seepage was 316 µg/l. The upstream winter Cu concentration in winter was 31 µg/l, the downstream concentration 51 µg/l. The difference of 20 µg/l is not particularly large but nevertheless may be attributable to the seepage. Increasing dilution downstream can be expected to reduce the Cu concentration further. The downstream concentration of 51 µg/l Cu exceeds upper limit of 30 µg/l set by the Draft EC Surface Water Regulations.

2. Groundwater (chemistry and flow information)

No groundwater samples were taken at Keeloge. A leachate sample was prepared using samples from SP01. Only Cu was significantly elevated relative to surface water samples for the area. The measured concentration (110 µg/l) exceeds the upper limit of 30 µg/l set by the Draft EC Surface Water Regulations EU Drinking Water Standard but is much lower than the current Drinking Water Standard of 2,000 µg/l (2 mg/l). On this basis, the solid mine waste at Keeloge is unlikely to be a concern in the context of contamination of drinking water. It could potentially contribute by baseflow to contamination of the surface water in the Keeloge River.

3. Stream Sediments

The concentrations of Cu in stream sediments in the Keeloge River are much higher in samples taken downstream of the mine site compared to one taken upstream. The upstream sample had 60 mg/kg Cu in the 150 µm fraction compared to 741 mg/kg immediately downstream of the mine. A second sample, taken 650m downstream of the mine, had 502 mg/kg Cu. Nickel (56 – 66 mg/kg) and Th (18 – 24 mg/kg) were also detected at low levels in both downstream samples but not in the upstream sample.

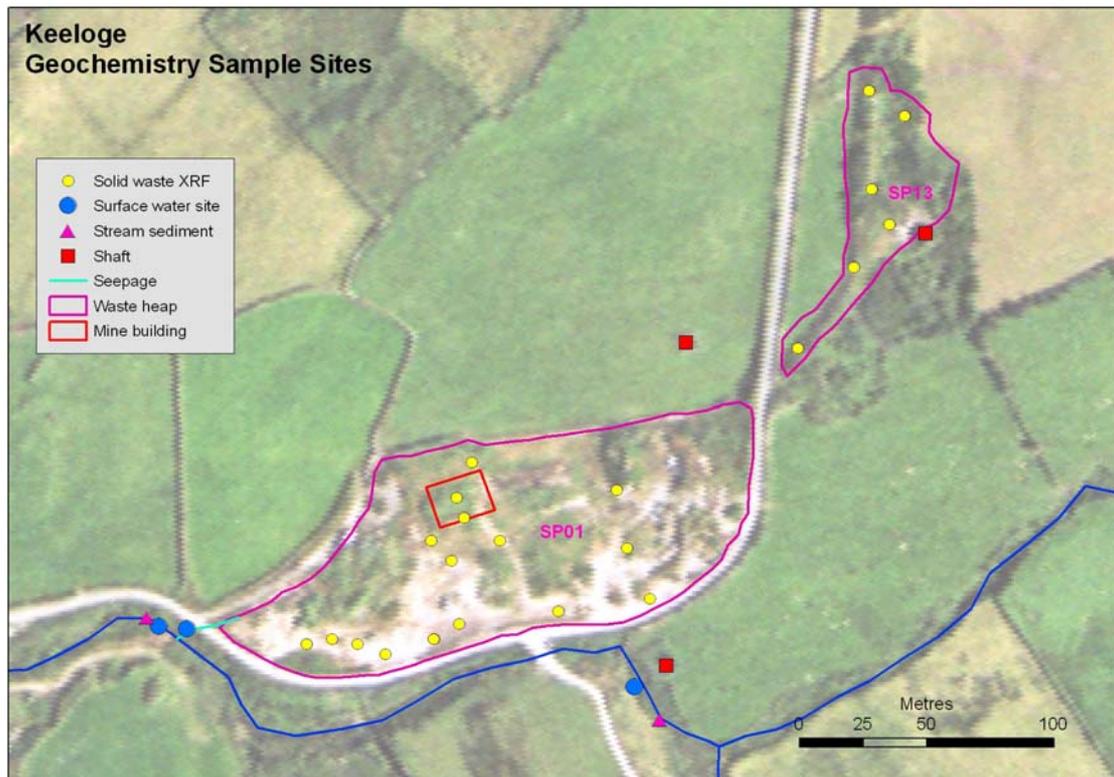


Fig. 2 Keeloge: Geochemical sampling sites

4. Solid Waste

The distribution of Cu in solid waste at Keeloge is illustrated in Fig. 3. The data have been classified using all field XRF analyses for Allihies so that the Keeloge values can be assessed in the context of the Allihies district as a whole. The Keeloge waste shows a good spread of Cu concentrations, with a maximum value, west of centre in SP01, of 6.6%. The median value of Cu is, however, considerably below that for Allihies as a whole.

Other elements detected are present in low measured concentrations (Table 2). One sample of probable stamps waste had 173 mg/kg Sb but otherwise measured concentrations of this element are low in samples analysed at Keeloge.

Table 2 Summary statistics, solid waste XRF geochemistry, Keeloge

mg/kg	Cu	Sb	As	Pb	Zn
n	25	25	25	25	25
Minimum	34	0.0	0.0	16	0.0
Maximum	66755	173	69	354	108
Mean	4862	40	25	74	18
Median	1495	0.0	24	40	0.0
Median (all Allihies)	2588	74	19	33	0.0

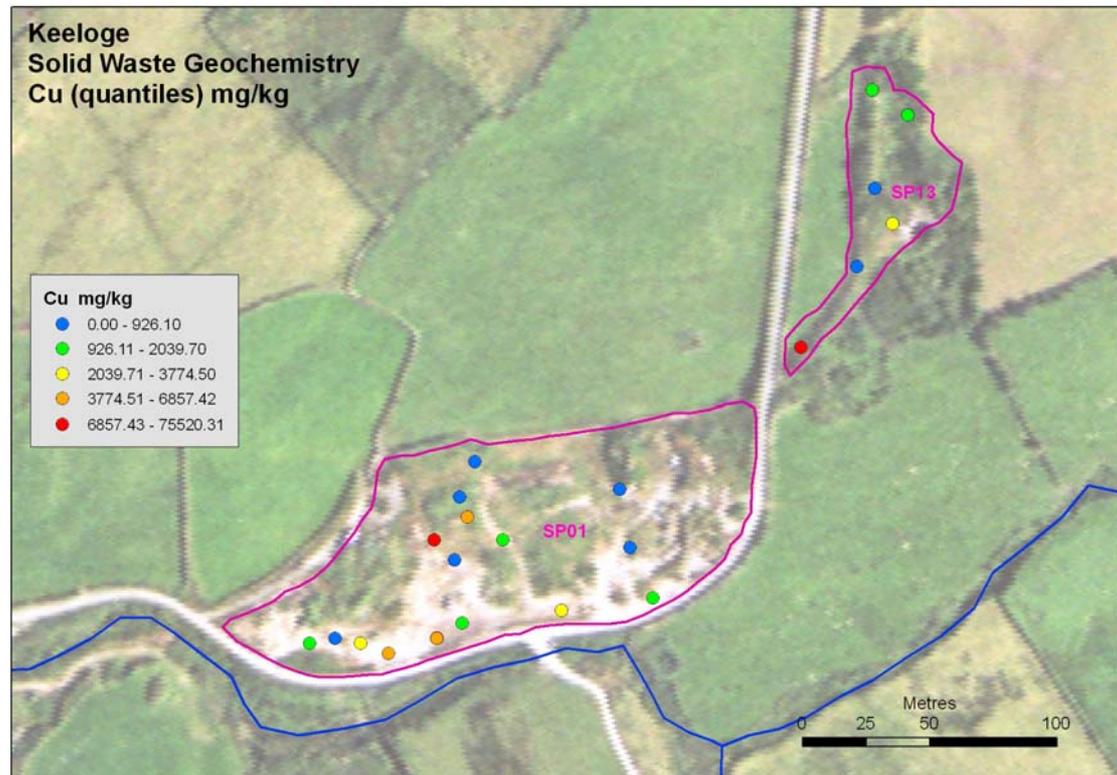


Fig. 3 Keeloge: Solid Waste Geochemistry

5. HMS-IRC Site Score

Table 3 HMS-IRC Site Score, Keeloge

Waste	SP01	SP013	Total
1. Hazard Score	12	11	22
2. Pathway Score			
<i>Groundwater</i>	0.94	0.88	1.82
<i>Surface Water</i>	4.05	0.07	3.82
<i>Air</i>	0.01	0.00	0.01
<i>Direct Contact</i>	0.25	0.01	0.26
<i>Direct Contact (livestock)</i>	-	-	-
3. Site Score	5	1	6

The total HMS-IRC Site Score for Keeloge is 6, with the main contribution coming from the old processing area (SP01) (Table 3). The proximity of the processing area to the Keeloge River is the main reason for the difference in the scores between the two waste heaps, since exceedances of the surface water standards in the river can be attributed to the processing area but not SP13, which is not close to the river.

As is the case for the Allihies District as a whole, the surface water pathway (66.3%) is much more significant contributor to the site score than the groundwater pathway (29.3%) (Fig. 4). The low volume of waste, the lack of important aquifers in the area and the low population density, and hence low number of possible wells, minimize the groundwater pathway contribution while the location of the waste directly beside the Keeloge River maximizes the surface water pathway contribution. The minor contribution of the Direct Contact and Air pathways follows from the relatively small area of the solid waste, the absence of significant concentrations of any elements of high relative toxicity and the absence of workers on the site. Stream sediments are scored as part of the district as a whole (see Allihies District report). The contamination of sediments in the Keeloge River over a distance exceeding 600m, a direct consequence of the operations on the processing area at Keeloge, contributes significantly to the total stream sediment score of 22 for the Allihies District.

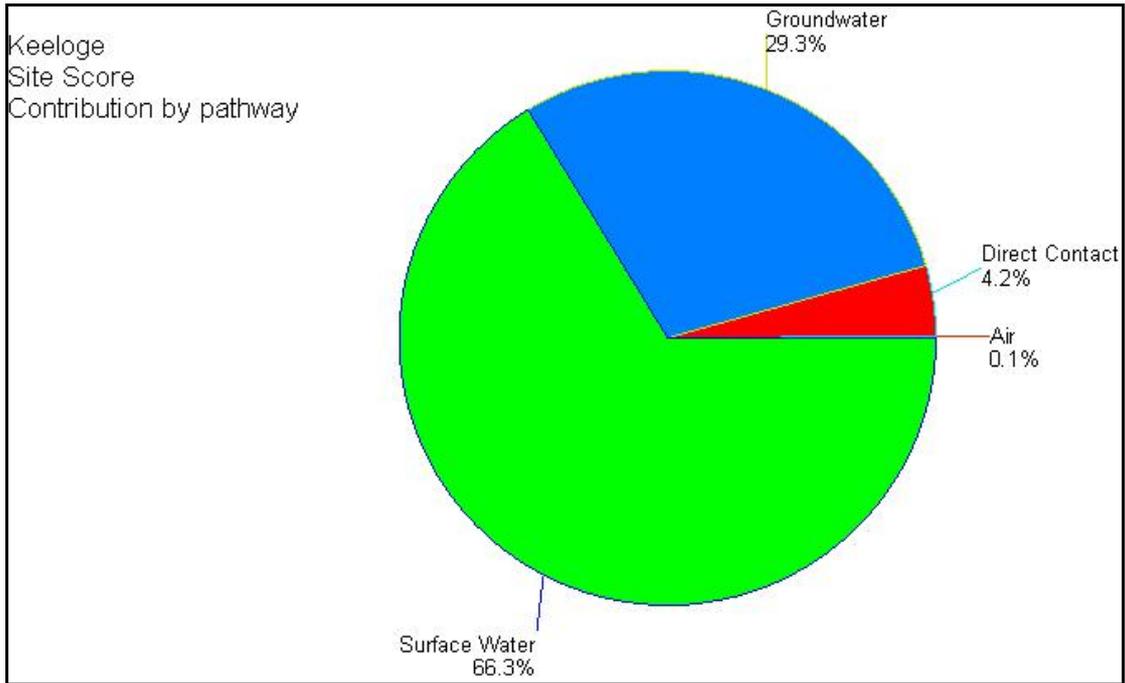


Fig. 4 Keeloge HMS-IRC Site Score: contribution by pathway

6. Geochemical overview and conclusions:

Solid mine waste on the Keeloge site contains some very high concentrations of Cu but median concentrations are lower than those for the Allihies district as a whole. Other elements are present in relatively low concentrations. The considerable quantities of material, including soil and builders rubble, imported onto the site subsequent to mining have obscured much of the original waste and possibly diluted its chemistry. Water in the Keeloge River immediately downstream of the site has a higher Cu concentration than that upstream and the measured concentration exceeds the Draft EC Surface Water Regulation limit. Cu is significantly elevated in stream sediments for at least 650m downstream of the site. Despite the high measured Cu concentrations in some of the processing waste, the total site score for Keeloge is just 6, a low score for a processing site by comparison with processing sites in other mine districts. The main reason for the low score is the absence of high concentrations of elements of high relative toxicity, such as Pb and As. Direct drainage of Cu-rich leachate to local streams appears to represent the most significant potential environmental risk on the site.