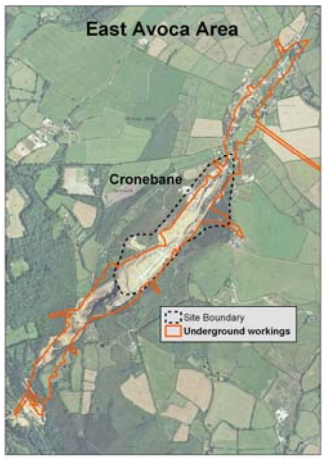
CRONEBANE

Background information



Mine Name: Cronebane

Mine District: Avoca

Alternative Names:
Cronebane

Chemicals of concern:
Pb, As, Cu, Zn

Project Prefix: AVO-

County:
Wicklow

Townland:
Cronebane

Grid Reference:
E320735, N183142

Site Description and Environmental Setting

Cronebane, immediately southwest of Connary, is a narrow, 900m-long northeast-southwest-trending site centred on Cronebane open pit. The southwestern end is dominated by Mount Platt, the large spoil heap created from the waste rock produced during excavation of the open pit (photo, left, viewed from northeast). The heathland northwest of the site is the highest ground in the East Avoca mine area and includes the site of the Mottee Stone, a large granite erratic, on its summit (Fig. 1). To the southeast of the site, a 100-300m-wide plantation of pine, larch and fir forms a buffer zone between the mine site and mixed farmland beyond. Several dwellings are clustered near the road at the northeastern end of the site. An unsealed road runs along the southeastern boundary, between the pit and the plantation, linking Connary to the northeast with Tigroney to the southwest. However, in recent years this road has been blocked by large boulders to prevent vehicular traffic entering the open pit area. The entire site is surrounded by a chain-link fence that has been breached in many places.

The open pit was originally almost 600m long and 120m wide. The southwestern end was backfilled with waste rock so that the exposed pit is now 350m-long and 40m-deep (Fig. 1). The backfilled area to the southwest forms a flat 200m-long plateau area that merges into the northeastern side of Mount Platt. Connary Minerals operated a gold leaching

plant on this plateau in the 1980s, using thiosulphate to extract gold from mine waste. The pond at the northeastern end of the pit (photo, above) was constructed by the company as a reservoir for the leach operation.

Several adits and levels are exposed in the floor and northwestern or hanging wall of the pit. In addition, apparently *in situ* timbers (photo, right), partially covered by spoil in the floor of the pit, mark the trace of other levels. Another adit, Madam Butler's, runs beneath the plantation to the southeast of the pit. It has partly collapsed to form an open trench. The entrance to the adit was originally in the farmyard southeast of the plantation and the adit drained southwards through farmland and eventually into the Sulphur Brook. In recent years the drainage channel has been piped and diverted. An air shaft on Madam Butler's adit, marked by a spoil heap, is now collapsed. There are no other shafts within the site. Fragments of walls of the carpenter's shop are the only remains of any mine buildings.

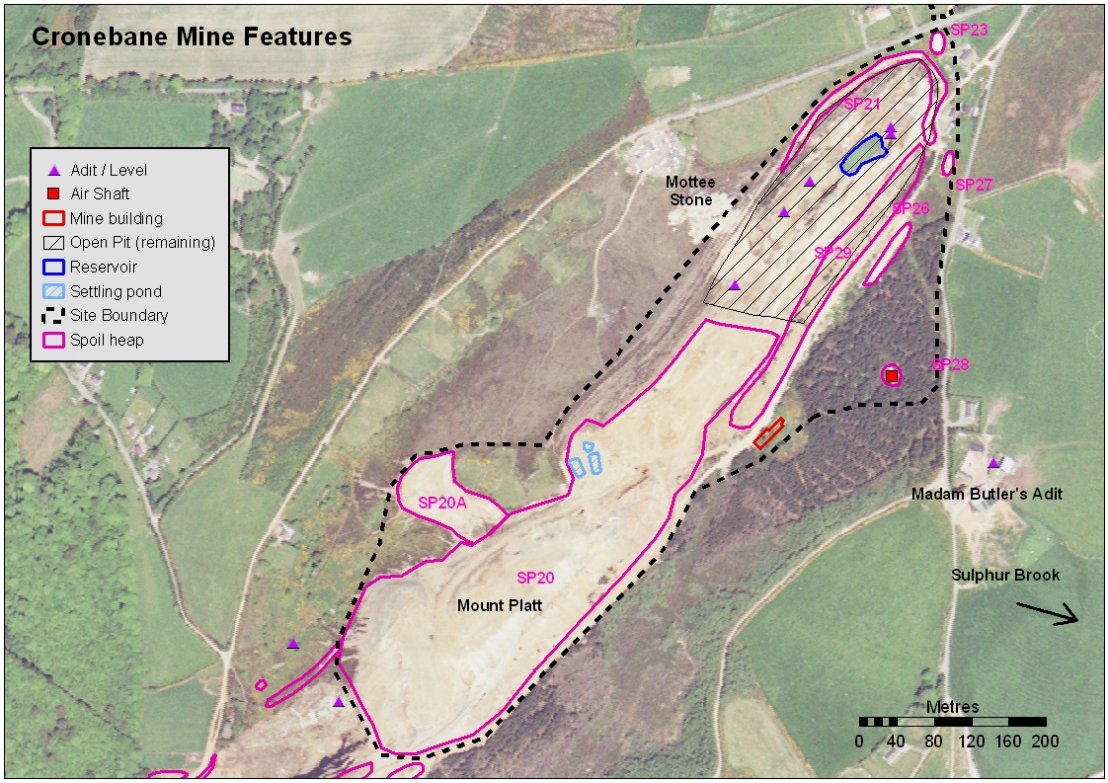


Fig. 1 Cronebane: mine features

Most of the ground is covered by a thin layer of mine waste, similar in texture and composition to much of the waste present in Avoca. Spoil heaps are distributed along the northeastern and southeastern rims of the site, on the plateau at the southwestern end of the pit and in several places in the plantation, notably around Madam Butler's adit. The major spoil heap, Mount Platt (SP20), dominates the southwestern end of the site and is a significant landmark in the area (photo, left).

Table 1 shows volume estimates for the spoil at Cronebane, indicating a total spoil volume of 863,675 m^3, of which Mount Platt and the open pit backfill account for 86%. Revegetation of spoil is minimal in the context of the site as a whole though considerable areas of the heaps at the northeastern end of the pit have been colonized by heather, gorse and pine trees. The latter have shown signs in recent years of becoming better established after initially very stunted growth in the 1980s and early 1990s.

Table 1 Area and volume of spoil heaps at Connary

Waste ID	Area (m^2)	Volume (m^3)
AVO-SP20/20A	77,193	854,170
AVO-SP21*	3,640	4,004
AVO-SP22	125*	203
AVO-SP26	828*	1,994
AVO-SP27	227**	227*
AVO-SP28	348*	402
AVO-SP29*	8,641	2,160

Source: LIDAR survey 2007 (CDM Report); * Gallagher and O'Connor 1997;
** HMS-IRC

Geochemical assessment

1. Surface water

Two seepages from Mount Platt were sampled in November 2006 for the HMS-IRC project (sites 1 and 2, Fig. 2). In addition, as part of the Avoca Feasibility Study, two other seepages were sampled, as well as the water in the reservoir at the northeastern end of the open pit (sites 3 – 5, Fig. 2) (CDM 2008). Discharge from Madam Butler's adit was not sampled as the owner of the farmyard where it previously discharged indicated that the water had been piped away from his land.

Results for some elements are shown in Table 2. The fifth sample (number 5 on Fig. 2) was analysed only for dissolved metals (CDM 2008). The highest concentrations of metals are found in the Mount Platt seepages. Apart from Pb, Zn and Cu, high levels of Cd and As were detected in some samples. The Mount Platt seepages are dependent on rainfall and can dry up completely in summer, though sample (5) was taken in August 2007. The seepages drain off the Cronebane site, running across and beside the unsealed road that bounds the site to the southeast, before seeping into the ground. Seepage (2) on Fig. 2 (photo, right) flowed at a rate of 0.04 l/s when sampled in November 2006.

Table 2: Data for surface water, Cronebane

	Pb (tot) µg/l	Zn (tot) µg/l	Cu (tot) µg/l	As (tot) µg/l	Cd (tot) µg/l	Cr (tot) µg/l	Acidity Mg/l $CaCO_3$
Mount Platt seep (1)	433	80990	30830	271	280	234	556
Mount Platt seep (2)	471	14170	7072	57	73	8	348
Open Pit seep (3)	901	5728	4988	< DL	16	3	185
Reservoir (4)	416	4390	3435	< DL	13	4	141
Mount Platt seep (5)	9	132900	88760	< DL	518	102	n/a

(1) numbers in brackets refer to map number (Fig. 2). Data for Mount Platt seep (5) are for dissolved metal rather than total metal.

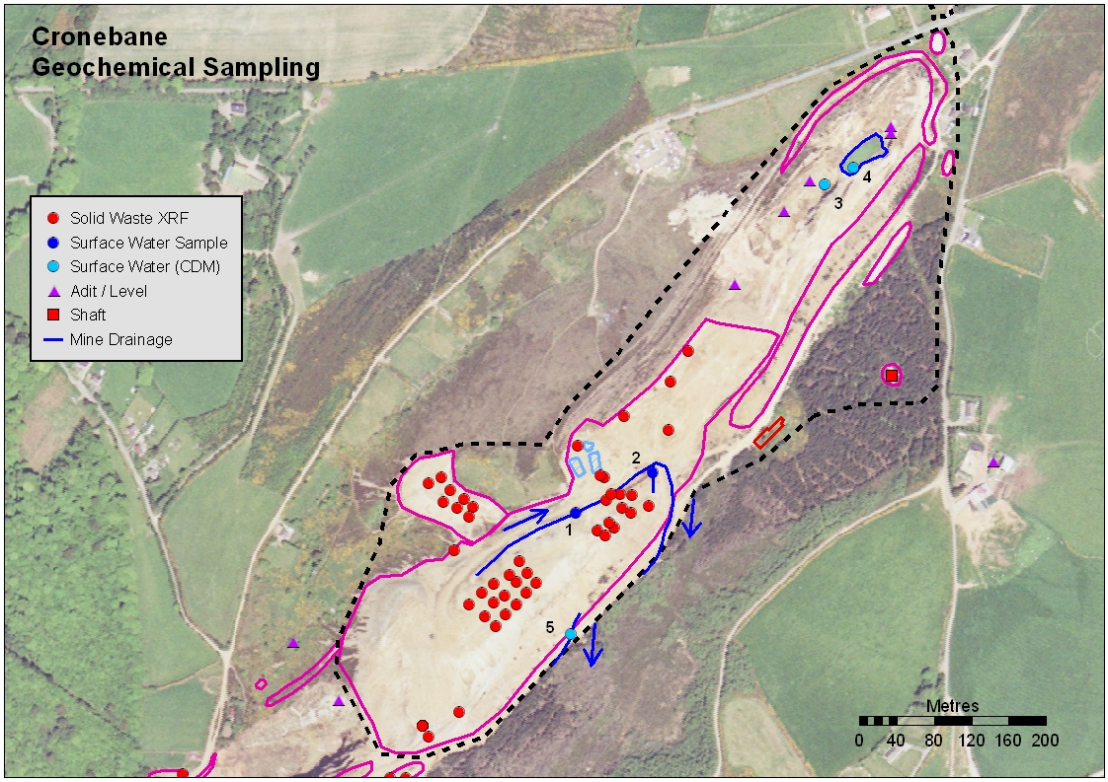


Fig. 2 Connary: Geochemical sampling sites

2. Groundwater

No groundwater sources were sampled for this project. Two composite spoil samples were subjected to a leachate test in order to assess the potential for groundwater contamination as a consequence of leaching of spoil. Compared to metal concentrations measured in seepages, the concentrations of metals in the leachate were low: 20 – 149 µg/l Cu, 35 – 51 µg/l Pb, <1 – 15 µg/l Zn. The concentration of As was below the detection limit in both cases. There seems little doubt, judging from the chemistry of the seepages, that the spoil at Cronebane has the potential to contaminate groundwater but these data were not replicated by the leachate test. This may reflect sampling or analysis conditions.

3. Stream sediments

No stream sediments were sampled in the Cronebane area. Sampling took place on the Avoca River and Sulphur Brook stream. Details are provided in the Avoca District report.

4. Solid Waste

Eight separate waste heaps are located within the Cronebane site (Fig. 1). Field XRF analyses of spoil on SP20 and SP20A (Mount Platt) were carried out in June 2007 (Fig. 2). In Fig. 3 and Table 3, the concentration of Pb and other elements of interest are compared to those for other spoil samples at Avoca. Median concentrations of Pb and Zn are similar to those measured in other spoil heaps in Avoca but As and Cu concentrations are lower. The very high median Pb concentrations measured at Connary are not repeated here. Several of those samples with highest Pb at Cronebane are from fine waste found northeast of the settling ponds used for the Au leach process in the 1980s.

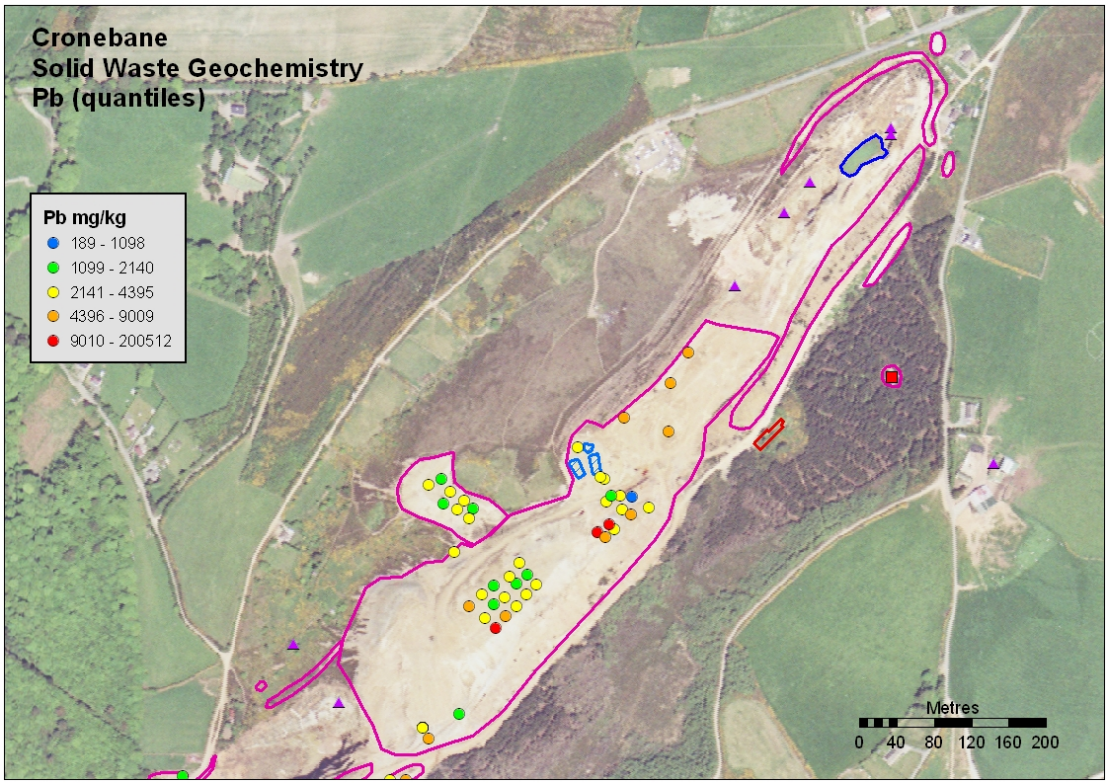


Fig. 3 Cronebane: Solid Waste Field XRF Geochemistry: Pb
(Note that quantile values listed in Legend relate to all Avoca spoil analyses)

Table 3: Summary statistics for field XRF analyses of solid waste, Cronebane

mg/kg	Pb	As	Sb	Cu	Zn
n	53	53	53	53	53
Minimum	326	63	0.0	61	0.0
Maximum	9754	1214	347	2318	894
Mean	3512	430	72	375	159
Median	2707	377	85	290	125
Median rest Avoca spoil (n=177)	2863	798	0.0	538	72

5. HMS-IRC Site Score

Table 4 HMS-IRC Site Score, Cronebane

Waste	SP20/20a	SP21	SP22c	SP26
1. Hazard Score	**648**	**21**	**17**	**19**
2. Pathway Score				
Groundwater	230.39	6.01	5.16	4.92
Surface Water	119.75	1.52	1.30	1.41
Air	2.28	0.19	0.01	0.01
Direct Contact	15.61	0.62	0.11	0.11
Direct Contact (livestock)				
3. Site Score	**368**	**8**	**7**	**6**

Waste	SP27	SP28	SP29	Totals
1. Hazard Score	**17**	**17**	**20**	**759**
2. Pathway Score				
Groundwater	4.56	4.55	5.84	261.42
Surface Water	1.30	1.36	1.49	128.13
Air	0.01	0.01	0.11	2.63
Direct Contact	0.11	0.05	1.37	17.98
Direct Contact (livestock)				
3. Site Score	**6**	**6**	**9**	**410**

The total site score for Cronebane is 410, all of it from solid waste heaps (Table 4). Mount Platt (SP20/20a), with a volume of over 800,000 m^3 accounts for 90% of this score. The remainder of the score is quite evenly divided among the other, much smaller heaps.

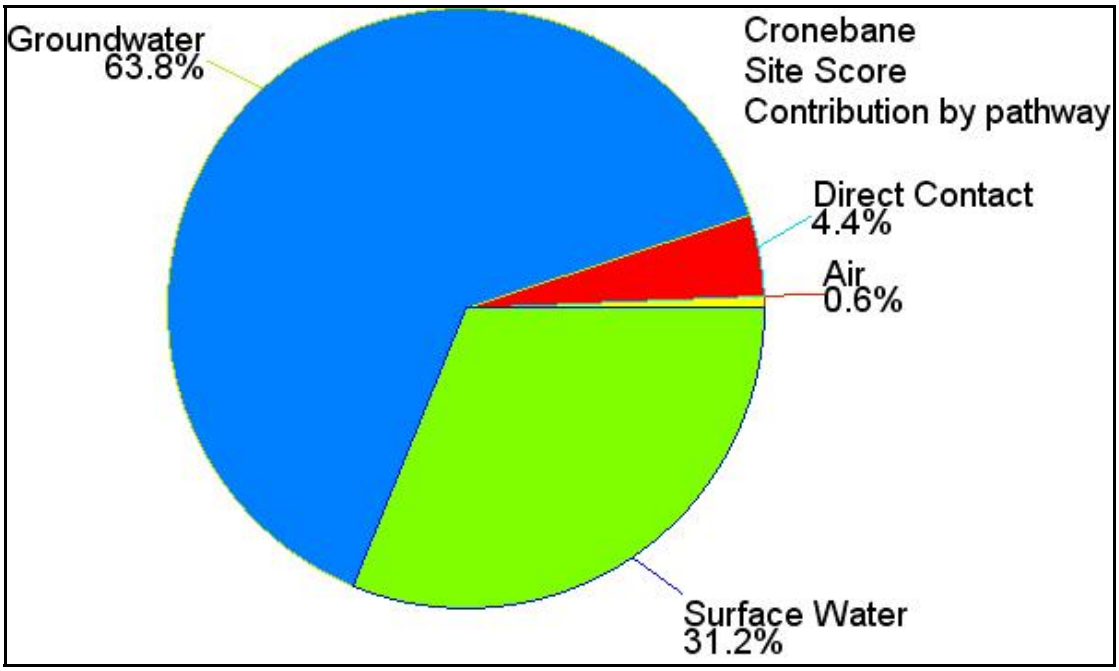


Fig. 4 Contribution of individual pathways to Cronebane Site Score

The contribution of individual pathways to the Cronebane Site Score is illustrated in Fig. 4. Pathways are the routes by which receptors are exposed to the hazard. At Cronebane, the proximity of numerous houses, and therefore potential wells, and the lack of any appreciable soil thickness combined with the high volume:area ratio of the spoil give a high relative score to the groundwater pathway. There are no streams likely to be affected directly by any run-off from spoil heaps and this reduces the surface water pathway relative to the groundwater pathway score. At Cronebane, as at Connary, the ratio of the groundwater pathway score to that of the surface water pathway is approximately 2:1. The direct contact pathway score and the air pathway score both comprise a very small part of the total site score. The reason for this is essentially the very high volume:area ratio mentioned above. This is largely a function of the construction of Mount Platt. The very large volume of the spoil gives rise to a very large hazard score for groundwater and surface water. Direct contact and air pathway scores are more dependent on the area of the spoil rather than the volume.

6. Geochemical overview and conclusions

The solid mine waste at Cronebane has concentrations of Pb, As, Cu and Zn that are typical of or somewhat lower than those measured elsewhere in Avoca. Measured concentrations of Pb in *in-situ* samples range up to in excess of 9000 mg/kg while those for As can exceed 1200 mg/kg. There is no evidence for any processing waste on site.

There are numerous breaches in the fencing on this site which has become popular with quad bikers. In consequence there is potential for direct contact with and / or inhalation of mine waste.

Although their metal concentrations and acidity can be extremely high, the largely seasonal spoil seepages have very low flow rates. They eventually seep into the ground, either spoil itself or soils along the edge of the site.

The discharge from Madam Butler's adit was not sampled. Evidence from stream sediment collected from the Sulphur Brook (see Avoca District report) suggests this adit was a significant source of metal-rich mine water in the past. It is not clear what has been done with this discharge in recent years – no trace of it was found on the farm land south of the original discharge point.

References

CDM (2008) Feasibility Study for management and remediation of the Avoca Mining site. Prepared for the Geological Survey of Ireland. CDM, USA.