

BALLYMURTAGH

Background information

Mine Name: Ballymurtagh

Mine District: Avoca

Alternative Names:

Elements of interest:

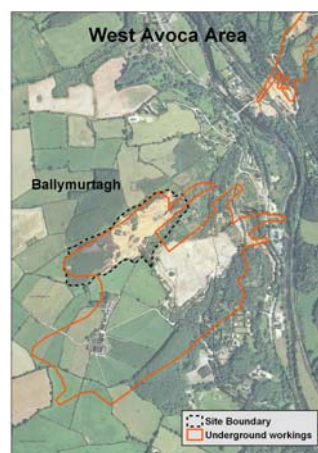
Pb, As, Cu, Zn

Project Prefix: AVO-

County:
Wicklow

Townland:
Ballymurtagh

Grid Reference:
E319276, N181526



Site Description and Environmental Setting

The Ballymurtagh site (photo, right) occupies the high ground northwest of the Ballygahan site, i.e. northwest of the old open pit and recent landfill at West Avoca. It incorporates the old North Lode site that was mined both by opencast and underground methods in the 19th century. The site was the location for extensive revegetation trials for the Avoca Life Project in the 1990s and these broadly successful trials have remediated part of what is essentially a large expanse of bare spoil. The site boundary (Fig. 1) encloses over 9 ha.



The site is bounded to the north, west and south by extensive tracts of farmland, mainly pasture, to the east by the wooded valley slopes with numerous single dwellings and to the southeast by the Ballygahan site (Fig. 1). The Ballymurtagh site is a topographic high on the West Avoca site and the land slopes downwards to the southwest, south and east. The North Lode consisted of thickly bedded massive pyrite overlain by supergene, weathered ore. The latter was mined by opencast and the resultant open pit was for a time one of the largest in the world. It had a length of c. 300m and average depth of 30m with an implied volume of over 230,000 m³ (Gallagher and O'Connor 1997). The pit was used for tailings disposal in the 1970s and is largely filled in, with a surface of fine spoil. Only the uppermost sections of the pit walls at the southwestern end of the pit remain as evidence of its existence. Weaver's Lode is the eastern extension of the North Lode and its open pit, a much smaller excavation than North Lode open pit, has not been filled in (photo, right). The



underground workings at Ballymurtagh were not as extensive as elsewhere in Avoca but, perhaps because of the site's somewhat isolated position, they remain largely untouched apart from capping and fencing of shafts and blocking of the adit. Four of the five shafts on the site (Fig. 1) appear to be secure but the **Air Shaft** is open and the fence around it breached. Another shaft, together with a small waste heap, is located 200m southwest of the site on Merrigan's farm. This shaft has been filled in.



The entrance to the **Spa Adit**, driven in the 1850s to provide access to the underground workings on Weaver's Lode, is closed up by concrete blocks but a pipe allows drainage of mine water. The only mine building on the site, the **Western Whim Engine House**, is almost completely demolished with only the circular, overgrown stone base of the chimney remaining. The main historical feature of interest is the **tramway arch** (photo, left). The tramway, built in the early 1840s to carry ore to Arklow, ran

from a point immediately southeast of the North Lode open pit (Fig. 1). Nothing remains of the tramway but the arch is well preserved.

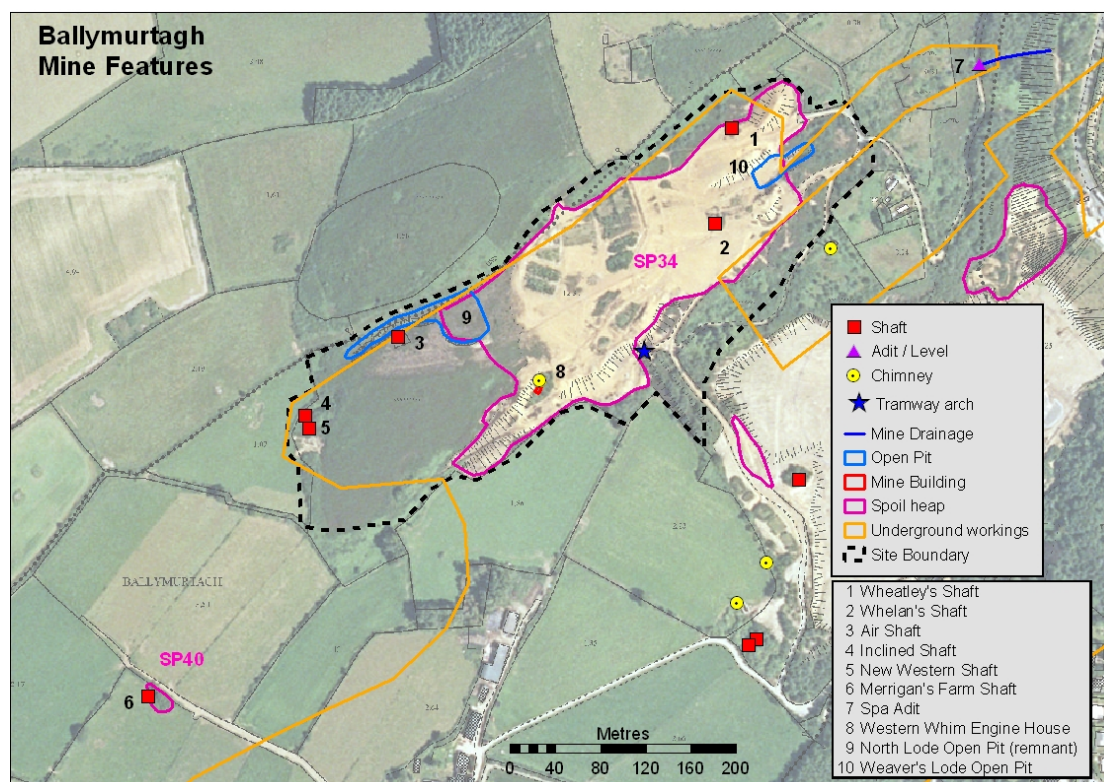


Fig. 1 Ballymurtagh: mine features

The remnant of the North Lode Open Pit is largely colonized by heather and gorse and the Avoca Life revegetation trials have succeeded in providing some cover for part of the remainder of the site. However, most of the site remains bare of vegetation (Fig. 1) and, for the purpose of the HMS-IRC project, is considered to constitute a single spoil heap, SP34. Within this several small heaps can be defined. A second spoil heap, SP40, is located beside the filled-in shaft on Merrigan's farm,

200m southwest of the site. This heap is largely hidden beneath a thick cover of gorse. Table 1 gives estimates of the area and volume of the waste heaps on the Ballymurtagh site.

Table 1 Area and volume of spoil heaps at Ballymurtagh

Waste ID	Area (m ²)	Volume (m ³)
AVO-SP34	43,202	*120,533
AVO-SP40	334	*632

Source: HMS-IRC, modified after Gallagher and O'Connor 1997;

* LIDAR survey 2007 (CDM Report).

Geochemical assessment

1. Surface water

No surface water samples were collected at Ballymurtagh. The Spa Adit discharges a small flow of mine water via a drainage pipe. The pipe is broken and the discharge seeps into the ground.

2. Groundwater

No groundwater sources were sampled for this project. A composite sample of spoil, comprising four samples from SP34 and one from SP36, was subjected to a leachate test. SP36 has been considered to be part of Ballygahan in this project and the sample used from it had a measured Pb concentration of 1.6% in comparison to a maximum of 4134 Pb in the SP34 samples. In consequence the leachate sample may have higher metal concentrations than expected of a sample composed only of material from SP34. The leachate had 512 µg/l Pb, 228 µg/l Cu, 7 µg/l Ni and 119 µg/l Zn, sufficient to indicate some risk to groundwater.

Water from a monitoring well 120m southeast of Weaver's Lode Open Pit was analysed for the Avoca feasibility Study (CDM 2008). Metal concentrations were lower than those measured in wells on the Ballymurtagh site but still indicate significant groundwater contamination in the vicinity of the mine site: 602 µg/l Cu, 10 µg/l Pb, 8 µg/l Ni and 533 µg/l Zn.

3. Stream sediments

Ballymurtagh is well removed from the Avoca River and has no direct impact on stream sediments. Details of stream sediment sampling and analyses for the HMS-IRC project are contained in the Avoca District report.

4. Solid Waste

A total of 55 *in situ* XRF analyses were carried out on solid waste at Ballymurtagh. The distribution of Pb is shown in Fig. 2. As with other Avoca sites, the quantile intervals shown are computed using all spoil samples analysed to allow comparison of Ballymurtagh samples with other Avoca samples. Table 2 summarizes the data for elements of interest.

As is clear from Fig. 2, Pb concentration in spoil at Ballymurtagh is generally lower than that measured elsewhere in Avoca, i.e. in East Avoca. Most measured values are within the lowest 40% of concentrations measured in Avoca. Table 2 shows that the median concentrations of Cu and Zn are also significantly lower than the median of all other spoil samples in Avoca. The median concentration of As is higher,

however, and Fig. 3 suggests that As is strongly enriched in Ballymurtagh spoil relative to spoil elsewhere in Avoca. Although it is possible to argue that disposal of tailings at Ballymurtagh has led to reduced metal concentrations in the waste, the relatively high As concentrations argue against such an interpretation.

Table 2: Summary statistics, field XRF analyses of solid waste, Ballymurtagh

mg/kg	Pb	As	Sb	Cu	Zn
n	55	55	55	55	55
Minimum	344	142	0.0	188	0.0
Maximum	8756	2069	122	880	167
Mean	1685	1014	4.2	366	17
Median	1056	987	0.0	342	0.0
Median rest Avoca spoil (n=175)	4430	547	0.0	577	136

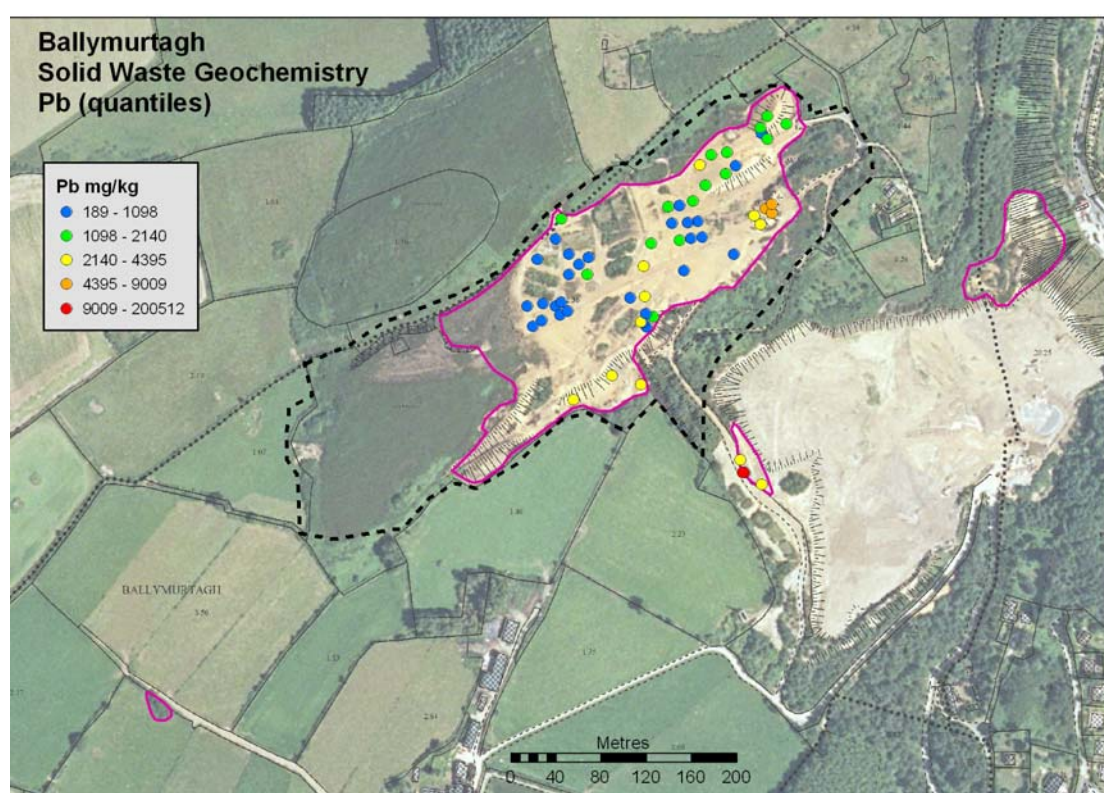


Fig. 2 Solid Waste Geochemistry, Ballymurtagh: Pb distribution

In general, Pb and As tend to correlate well in Avoca spoil so these results are somewhat unusual. Fig. 4 and X.5 are bivariate plots of Pb and As. Fig. 4 shows the correlation between Pb and As for *in situ* spoil analyses on spoil heaps other than SP34; Fig. 5 shows the plot for SP34 itself. The difference is clear and is suggestive of a different mineralogy at Ballymurtagh.

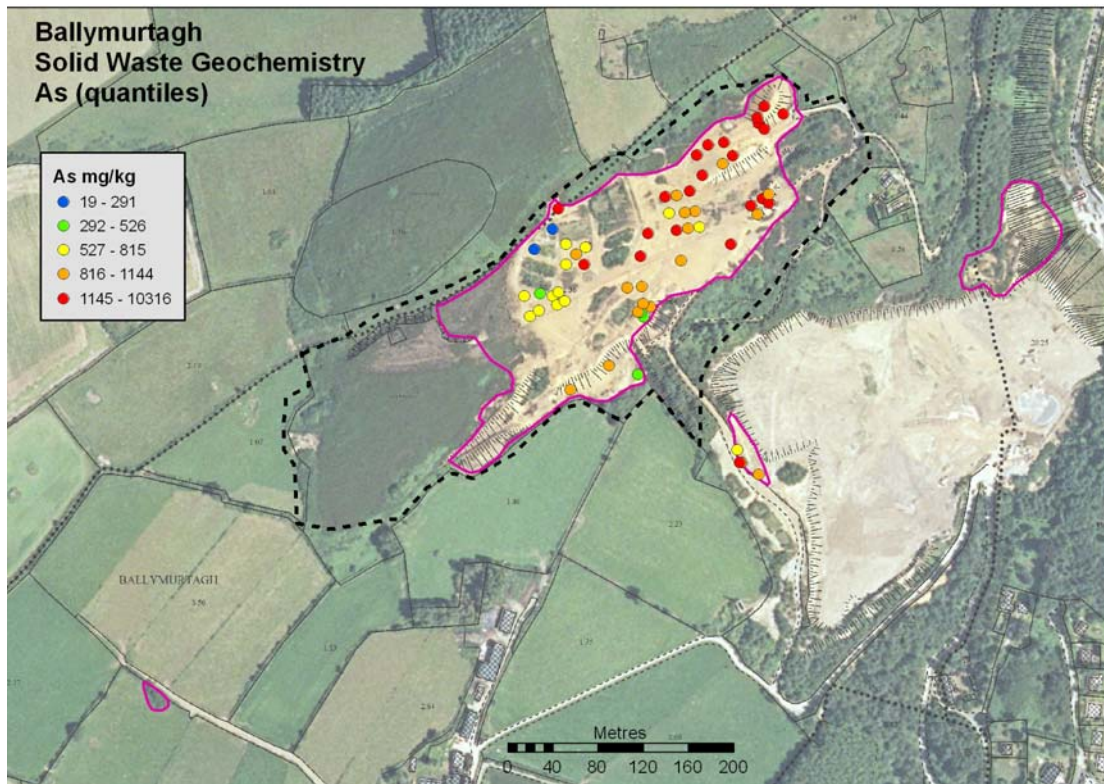


Fig. 4 Solid Waste Geochemistry, Ballymurtagh: Pb distribution

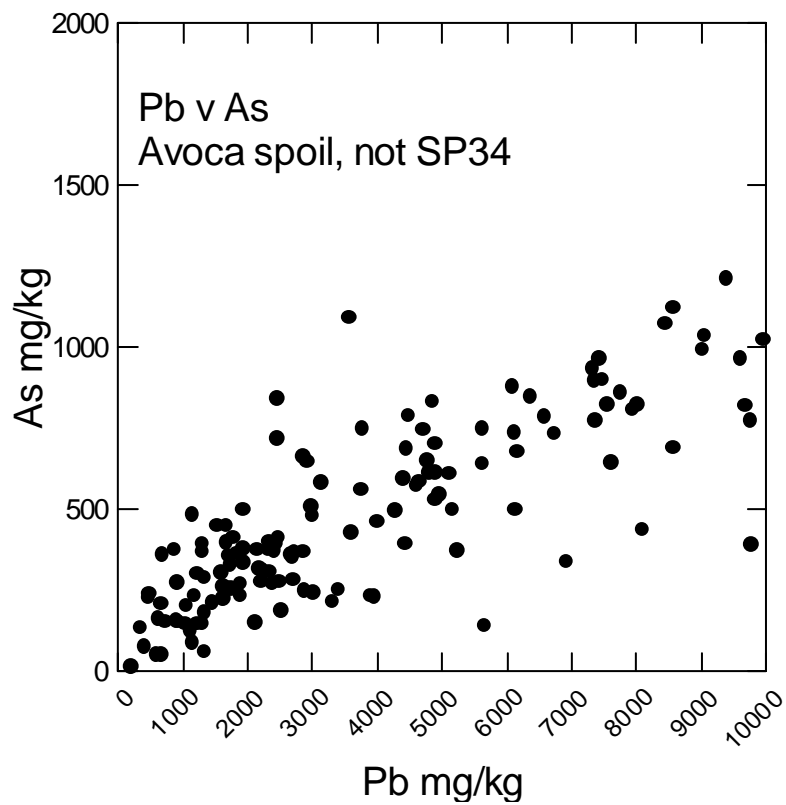


Fig. 4 Pb v As in spoil heaps other than SP34, Avoca

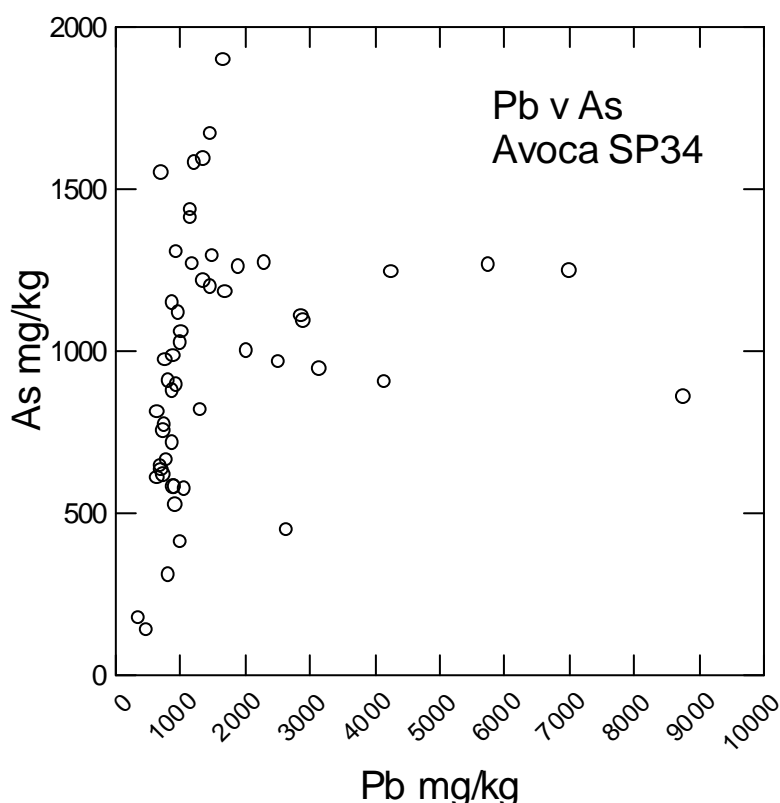


Fig. 5 Pb v As in spoil heap SP34, Ballymurtagh

The spoil heap at Merrigan's farm, SP40, is not included in the above summary. Several samples were analysed in the field under somewhat different conditions and were thus not included for direct comparison with other data. The samples were retrieved by the land owner and placed in plastic bags. XRF analysis was carried out through the bag. The spoil was a relatively coarse, grey-green slaty spoil, different in appearance to the red-brown material that predominates at Ballymurtagh and elsewhere in Avoca. In the four samples analysed, concentrations of elements of interest were generally low, with Pb ranging from 294 to 1274 mg/kg, As 57 to 97 mg/kg, Cu <DL to 88 mg/kg and Zn 54 to 85 mg/kg.

5. HMS-IRC Site Score

Table 3 HMS-IRC Site Score, Ballymurtagh

Waste	SP34	SP40	Totals
1. Hazard Score	86	15	101
2. Pathway Score			
<i>Groundwater</i>	24.71	3.95	28.66
<i>Surface Water</i>	5.80	1.22	7.02
<i>Air</i>	1.20	0.00	1.20
<i>Direct Contact</i>	10.23	0.03	10.26
<i>Direct Contact (livestock)</i>			
3. Site Score	42	5	47

Almost 90% of the waste score is contributed by SP34, the main area of spoil on the site of the old North Lode open pit. Its relatively low Pb concentration gives rise to a smaller score than might be expected given the large volume (>120,000 m³) of material. Fig. 5 shows the contributions of the various pathways to the site score.

The lack of any discharge to and distance from the Avoca River mean that the direct contact pathway and the air pathway have higher relative scores than have been observed elsewhere in Avoca. The large groundwater-to-surface water ratio reflects the distance of the site from the river and the lack of a drainage channel leading to it from the site.

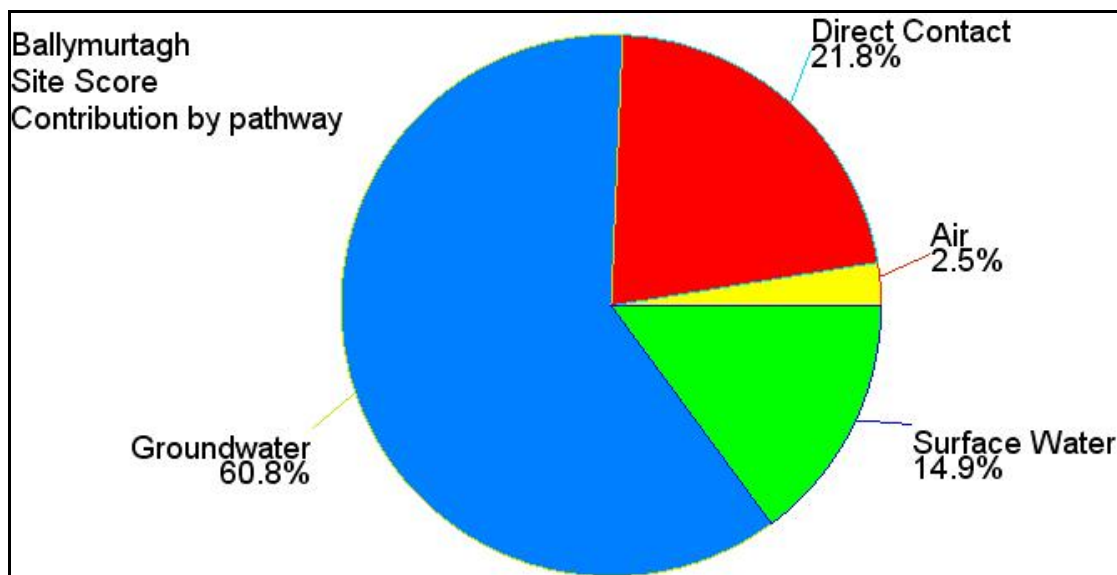


Fig. 6 Contribution of individual pathways to Ballymurtagh Site Score

6. Geochemical overview and conclusions

Overall, concentrations of elements of interest are relatively low in spoil at Ballymurtagh compared to spoil in East Avoca. Median values of Pb, Cu and Zn are considerably lower than those for other spoil heaps in the district. The one exception is As which is relatively enriched in the Ballymurtagh spoil, possibly reflecting a changed mineralogy relative to spoil from other parts of the Avoca site.

A leachate test on a composite sample of spoil suggests potential to contaminate groundwater in the vicinity of the site. Water from a monitoring well downhill and east of the site had high measured concentrations of Cu and Zn.

References

- CDM (2008) Feasibility Study for management and remediation of the Avoca Mining site. Prepared for the Geological Survey of Ireland. CDM, USA.
- Gray, N.F. (1995) Main adit flow and metal discharge rates. Water Technology Research, Technical Report 13, November 1995. Trinity College Dublin