Lead and Arsenic Bioaccessibility and Speciation as a Function of Soil Particle Size

This dataset contains 1) table of bulk Pb-XAS LCF results, 2) table of bulk As-XAS LCF results, 3) figure data of particle size distribution, and 4) figure data for the relationship of As and Pb %IVBA in the <250 µm sieved size fraction vs sieved <250 µm to >150 µm, <150 µm to >75 µm, <75 µm to >38 µm, and <38 µm; and <250 µm ground, and <150 µm sieved and ground.

Table 1: Bulk Pb-XAS LCF results for HSJ 583, IKJ 583, BO, and SOFc-1 showing
% components of lead minerals.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples  | Pb\_Humic Acids | Pb\_FH | Magnetoplumbite | Anglesite | Plumboferrite | Pb-phosphate  | Plumbojarosite  | Litharge  | Hydroxypyromorphite | R-factor |
| HSJ <250 - >150 S  | ­- | ­- | ­- | ­- | ­- | 14 | 86 | ­- | ­- | 0.107 |
| HSJ <150 - >75 S  | ­- | ­- | ­- | ­- | ­- | 3 | 97 | ­- | ­- | 0.067 |
| HSJ <75 - >38 S  | ­- | ­- | ­- | ­- | ­- | ­- | 96 | ­- | 4 | 0.074 |
| HSJ <38 S  | ­- | ­- | 7 | ­- | ­- | ­- | 93 | ­- | ­- | 0.068 |
| HSJ <250 S  | ­- | ­- | ­- | ­- | ­- | 9 | 91 | ­- | ­- | 0.294 |
| HSJ <250 P  | ­- | ­- | ­- | ­- | ­- | 18 | 82 | ­- | ­- | 0.074 |
| HSJ <150 S  | ­- | ­- | ­- | ­- | ­- | 10 | 90 | ­- | ­- | 0.107 |
| HSJ <150 P  | ­- | ­- | ­- | ­- | ­- | ­- | 92 | ­- | 8 | 0.070 |
| IKJ <250 - >150 S  | ­- | ­- | 36 | ­- | ­- | - | 52 | 5 | 7 | 0.003 |
| IKJ <150 - >75 S  | ­- | ­- | 44 | ­- | ­- | 12 | 44 | ­- | ­- | 0.008 |
| IKJ <75 - >38 S  | ­- | ­- | 21 | ­- | ­- | 34 | 37 | 8 | ­- | 0.003 |
| IKJ <38 S  | ­- | ­- | 36 | ­- | ­- | 12 | 48 | 4 | ­- | 0.003 |
| IKJ <250 S  | ­- | 23 | ­- | ­- | ­- | ­- | 75 | 5 | ­- | 0.002 |
| IKJ <250 P  | ­- | 21 | 20 | ­- | ­- | ­- | 59 | ­- | ­- | 0.003 |
| IKJ <150 S  | ­- | 22 | ­- | 4 | ­- | ­- | 74 | ­- | ­- | 0.003 |
| IKJ <150 P  | ­- | 8 | 22 | ­- | ­- | 12 | 58 | ­- | ­- | 0.003 |
| BO <250 - >150 S  | 9 | 91 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.085 |
| BO <150 - >75 S  | 9 | 91 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.147 |
| BO <75 - >38 S  | 9 | 91 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.285 |
| BO <38 S  | ­- | 100 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.102 |
| BO <250 S  | ­- | 99 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.133 |
| BO <250 P  | ­- | 100 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.287 |
| BO <150 S  | 9 | 91 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.133 |
| BO <150 P  | 7 | 93 | ­- | ­- | ­- | ­- | ­- | ­- | ­- | 0.049 |
| SOFc-1 <250 - >150 S  | ­- | 10 | ­- | 51 | ­- | ­- | ­- | 12 | 27 | 0.024 |
| SOFc-1 <150 - >75 S  | ­- | ­- | ­- | 40 | 11 | ­- | ­- | 16 | 32 | 0.022 |
| SOFc-1 <75 - >38 S  | ­- | 32 | ­- | 46 | 2 | ­- | ­- | ­- | 20 | 0.017 |
| SOFc-1 <38 S  | ­- | 11 | ­- | 56 | ­- | ­- | ­- | 11 | 23 | 0.011 |
| SOFc-1 <250 S  | ­- | 10 | ­- | 53 | ­- | ­- | ­- | 10 | 27 | 0.025 |
| SOFc-1 <250 P  | ­- | 18 | ­- | 52 | ­- | ­- | ­- | 8 | 23 | 0.020 |
| SOFc-1 <150 S  | ­- | 27 | ­- | 49 | ­- | ­- | ­- | 4 | 20 | 0.020 |
| SOFc-1 <150 P  | ­- | 32 | ­- | 47 | ­- | ­- | ­- | ­- | 21 | 0.025 |

The letter ‘S’ indicates sieved, ‘P’ indicates ground in sample labels. The phase identified
as less than 10% may not be significant due to error associated with smaller estimations.

Table 2: Bulk As-XAS LCF results for HSJ 583, IKJ 583, BO, and SoFC-1 showing
% components of arsenic minerals.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | As(V)\_Haematite  | Arsenopyrite  | As\_coppt. With Pyrite  | As(V)\_GOE  | As(V)\_BIR | Pb-As-Pesticide  | As(V)\_Jarosite | Scorodite  | R-factor |
| HSJ <250 - >150 S  | ­- | ­- | ­- | 22 | ­- | ­- | 78 | ­- | 0.035 |
| HSJ <150 >75 S  | ­- | ­- | ­- | 33 | ­- | ­- | 67 | ­- | 0.021 |
| HSJ <75 - G38 S  | ­- | ­- | ­- | 11 | ­- | ­- | 89 | ­- | 0.034 |
| HSJ <38 S  | 7 | ­- | ­- | 22 | ­- | ­- | 71 | ­- | 0.036 |
| HSJ <250 S  | ­- | ­- | ­- | 25 | ­- | ­- | 75 | ­- | 0.029 |
| HSJ <250 P  | ­- | ­- | ­- | 15 | ­- | ­- | 85 | ­- | 0.035 |
| HSJ <150 S  | 5 | ­- | ­- | 19 | ­- | ­- | 80 | ­- | 0.031 |
| HSJ <150 P  | ­- | ­- | ­- | 24 | ­- | ­- | 76 | ­- | 0.038 |
| IKJ <250 - G150 S  | ­- | ­- | ­- | ­- | ­- | ­- | 70 | 30 | 0.03 |
| IKJ <150 - G75 S  | ­- |  | ­- | ­- | ­- | ­- | 65 | 35 | 0.029 |
| IKJ <75 - G38 S  | ­- | ­- | ­- | ­- | ­- | ­- | 62 | 38 | 0.028 |
| IKJ <38 S  | ­- | ­- | ­- | 18 | ­- | ­- | 49 | 33 | 0.086 |
| IKJ <250 S  | ­- | ­- | ­- | ­- | ­- | ­- | 65 | 35 | 0.028 |
| IKJ <250 P  | ­- | ­- | ­- | ­- | ­- | ­- | 69 | 31 | 0.031 |
| IKJ <150 S  | ­- | ­- | ­- | 14 | ­- | ­- | 52 | 34 | 0.019 |
| IKJ <150 P  | ­- | ­- | ­- | ­- | ­- | ­- | 67 | 33 | 0.029 |
| BO <250 - >150 S  | ­- | ­- | ­- | ­- | 67 | 33 | ­- | ­- | 0.055 |
| BO <150 - >75 S  | ­- | ­- | ­- | ­- | 67 | 33 | ­- | ­- | 0.063 |
| BO <75 - >38 S  | ­- | ­- | ­- | ­- | 67 | 33 | ­- | ­- | 0.058 |
| BO <38 S  | ­- | ­- | ­- | ­- | 69 | 31 | ­- | ­- | 0.04.4 |
| BO <250 S  | ­- | ­- | ­- | ­- | 65 | 36 | ­- | ­- | 0.062 |
| BO <250 P  | ­- | ­- | ­- | ­- | 67 | 33 | ­- | ­- | 0.055 |
| BO <150 S  | ­- | ­- | ­- | ­- | 66 | 34 | ­- | ­- | 0.064 |
| BO <150 P  | ­- | ­- | ­- | ­- | 67 | 33 | ­- | ­- | 0.057 |
| SOFc-1 <250 - >150 S  | 84 | 16 | ­- | ­- | ­- | ­- | ­- | ­- | 0.134 |
| SOFc-1 <150 - >75 S  | 77 | 23 | ­- | ­- | ­- | ­- | ­- | ­- | 0.125 |
| SOFc-1 <75 - >38 S  | 78 | 22 | ­- | ­- | ­- | ­- | ­- | ­- | 0.126 |
| SOFc-1 <38 S  | 92 | ­- | 8 | ­- | ­- | ­- | ­- | ­- | 0.128 |
| SOFc-1 <250 S  | 95 | ­- | 5 | ­- | ­- | ­- | ­- | ­- | 0.125 |
| SOFc-1 <250 P  | 77 | 23 | ­- | ­- | ­- | ­- | ­- | ­- | 0.13 |
| SOFc-1 <150 S  | 76 | 24 | ­- | ­- | ­- | ­- | ­- | ­- | 0.04 |
| SOFc-1 <150 P  | 82 | 33 | ­- | ­- | ­- | ­- | ­- | ­- | 0.13 |

BIR- Birnessite, GOE- Goethite in minerals naming. The letter ‘S’ indicates sieved, ‘P’ indicates ground in sample labels. The phase identified as less than 10% may not be significant due to error associated with smaller estimations.

Figure 1: Particle size distribution in BO soil, HSJ 583, IKJ 583, and USGS Bioavailability Reference Material (SOFc-1).



|  |  |
| --- | --- |
|  | Particle Size Distribution |
| Sample | <250\_>150um | <150\_>75um | <75\_>38um | <38um |
| BO  | 32.85 | 22.59 | 38.71 | 5.84 |
| HSJ | 68.23 | 24.50 | 6.72 | 0.54 |
| IKJ | 40.28 | 22.34 | 23.11 | 14.27 |
| SOFc-1 | 45.89 | 30.10 | 13.82 | 10.20 |

Figure 2: The relationship of As and Pb %IVBA in the <250 µm sieved size fraction vs sieved <250 µm to >150 µm, <150 µm to >75 µm, <75 µm to >38 µm, and <38 µm; and <250 µm ground, and <150 µm sieved and ground. Figure 2A illustrates the As %IVBA in the size fraction groups (<250 µm to >150 µm, <150 µm to >75 µm, <75 µm to >38 µm, and <38 µm) relative to As %IVBA in the <250 µm sieved size fraction are nearly identical regardless of particle size. The same 1:1 agreement with the size fraction groups for Pb %IVBA is observed in Figure 2C. On the issue of <250 µm versus <150 µm for sieved and ground samples, Figures 2B and 2D demonstrate a close correlation when the <250 µm sieved size fraction is compared to the <250 µm ground, <150 µm sieved, and <150 µm ground size fractions.



|  |  |
| --- | --- |
| **2A** | As IVBA (%) |
| Sample | <250 um Sieved | <250um - >150um | <150um - >75um | <75um - >38um | <38um |
| HSJ 583 | 66.71 | 67.41 | 66.03 | 64.18 | 66.28 |
| IKJ 583 | 8.71 | 9.28 | 9.36 | 8.39 | 6.16 |
| BO | 30.63 | 29.11 | 30.56 | 30.99 | 32.82 |
| SRM | 18.74 | 17.87 | 15.81 | 20.46 | 21.76 |
|  |  |  |  |  |  |
| **2B** | As IVBA (%) |  |
| Sample | <250 um Sieved | <250um Pulverized | <150um Sieved | <150um Pulverized |  |
| HSJ 583 | 66.71 | 64.26 | 64.71 | 64.16 |  |
| IKJ 583 | 8.71 | 10.83 | 7.86 | 9.19 |  |
| BO | 30.63 | 35.05 | 31.13 | 34.45 |  |
| SRM | 18.74 | 21.77 | 18.59 | 17.88 |  |
|  |  |  |  |  |  |
| **2C** | Pb IVBA (%) |
| Sample | <250 um Sieved | <250um - >150um | <150um - >75um | <75um - >38um | <38um |
| HSJ 583 | 1.65 | 1.7 | 2.26 | 3.43 | 3.94 |
| IKJ 583 | 1.24 | 1.35 | 1.37 | 1.18 | 0.88 |
| BO | 71.64 | 68.89 | 69.82 | 70.05 | 74.4 |
| SRM | 71.77 | 71.32 | 65.12 | 75.07 | 81.62 |
|  |  |  |  |  |  |
| **2D** | Pb IVBA (%) |  |
| Sample | <250 um Sieved | <250um Pulverized | <150um Sieved | <150um Pulverized |  |
| HSJ 583 | 1.65 | 3.89 | 1.84 | 5.94 |  |
| IKJ 583 | 1.24 | 2.98 | 1.2 | 2.84 |  |
| BO | 71.64 | 75.31 | 71.59 | 73.91 |  |
| SRM | 71.77 | 75.63 | 72.35 | 76.59 |  |