Patterns of Trace Element Distributions in the Urban Desert System

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In this study, we are generating trace element distributions in the Central Arizona-Phoenix ecosystem by determining concentrations in surface soil samples (top 10 cm) from the 200 point survey in 2005, and developing testable hypotheses about sources and transport mechanisms. We are using a concentrated acid mixture to dissolve soil with microwave digestion, analyzing the trace elements in the samples by inductively coupled plasma mass spectrometry (ICP-MS), and plotting the results using a geographical information system.

ICP-MC Analysis Data Quality by Standard 1640

<table>
<thead>
<tr>
<th>Elements</th>
<th>Cd</th>
<th>Pb</th>
<th>V</th>
<th>Cr</th>
<th>Co</th>
<th>Ni</th>
<th>As</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection Limit</td>
<td>0.228</td>
<td>0.279</td>
<td>0.260</td>
<td>0.386</td>
<td>0.203</td>
<td>2.740</td>
<td>0.267</td>
</tr>
<tr>
<td>Run 1 PR%</td>
<td>115</td>
<td>122</td>
<td>124</td>
<td>120</td>
<td>124</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
<td>Run 2 PR%</td>
<td>99</td>
<td>103</td>
<td>120</td>
<td>111</td>
<td>120</td>
<td>116</td>
<td>112</td>
</tr>
<tr>
<td>Run 3 PR%</td>
<td>119</td>
<td>106</td>
<td>107</td>
<td>105</td>
<td>108</td>
<td>108</td>
<td>122</td>
</tr>
</tbody>
</table>

200 samples were finished in 3 runs of ICP-MS. The percent recoveries for the 1640 standard are within the acceptable range of ± 25%, which means the analysis is good.

GIS Plot for Pb Distribution

GIS Plot for Cd Distribution

GIS Plot for V Distribution

GIS Plot for Ni Distribution

GIS Plot for As Distribution

Data were plotted with Geological Information System, and classified with Jenks Natural Breaks.

Investigation Purpose:
Map the spatial distribution of trace element; Compare with different landuse types; Determine the sources and sinks and whether there are hot spots.

Further Studies:
Soil profiles to evidence the source; Historical landuse types to explain elements distribution and human activity.

V and some other elements show little to no variation that depends on landuse. Ni, As and some other elements seem to have multiple sources. Although there is no apparent highest concentration in the urban, urban area seem to have more higher concentration spots.

Detection Limit and Percent Recoveries for Three Runs

Elements that correlate positively with urbanization (Pb and Cd) have the highest urban maximum and concentration range. High concentrations tend to be distributed in urban center.

NIST Standard Percent Recovery %
(data analyzed by ICP/certified value)

The yellow area is the range of acceptable value, and those elements are within the acceptable value with a comparatively small range. Therefore the microwave digestion is good.