ASSESSING BACKGROUND VALUES OF METALS AND METALLOIDS IN SOILS OF THE VENETO REGION

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Summary

1) Natural content of metals in soil
2) What is background level
3) Investigation strategy
4) Depositional Units
5) Results: background values for Veneto Region
Starting point

Sustainable land management needs to be based on reliable data including ones related to soil contamination.

In order to assess soil contamination by metals it is necessary to know natural content due to the composition of the minerals in parent material.
<table>
<thead>
<tr>
<th>Metal</th>
<th>Granite</th>
<th>Serpentine</th>
<th>Basalt</th>
<th>Shale</th>
<th>Sandstone</th>
<th>Limestone</th>
<th>Limits It. Law</th>
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<td>85</td>
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<td>20</td>
<td>150</td>
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</tbody>
</table>
Since 1995 during soil survey sample were collected for analysis of metals:
- 1:50,000 scale (about 60% of plain and hills)
- 1:250,000 scale (the entire territory)

Most samples from profiles
SURVEYED AND PUBLISHED AREAS
SURVEYED AREAS
SURVEYING AREAS
Pedo-geochemical background content:
the concentration of elements generated by the characteristic features of pedogenesis, such as the composition and alteration of the rock and any subsequent movements in soil.

Background content:
the concentration of an element in a specific type of soil, located in an area or region, resulting from both natural, geological and pedological processes and including diffuse source inputs, such as atmospheric deposition and agricultural practices.
TYPOLOGICAL APPROACH

1363 UPPER LAYER SAMPLES
1119 PLAIN
244 MOUNTAIN

1030 LOWER LAYER SAMPLES
835 PLAIN
195 MOUNTAIN

DENSITY: 0.075/kmq
PLAIN: 0.093
MOUNTAIN: 0.041
CHOICE OF SAMPLING SITES

HOMOGENEOUS AREAS FOR PARENT MATERIAL

PLAIN: soils were formed by alluvial deposits
   • Depositional Units: Po, Adige, Brenta, Piave, Tagliamento and other smaller fans

MOUNTAIN: soils were formed by alteration of rocks on-site
   • Physiographic Units: Hard Limestones, Basalts, Granites, Marls, Conglomerates, etc.
SAMPLING DEPTH

PLAIN

- **Background**: topsoil (10-40 cm)
- **Pedo-geo background**: lower layer at C horizon level (80-120 cm)

MOUNTAIN

- **Background**: (topsoil: depth depending on soil use)
- **Pedo-geo background**: lower layer at C horizon level (under 70 cm if possible)
Analysis on fraction less than 2 mm (*terra fine*):


**General parameters:** pH, texture, organic carbon, total carbonates, cation exchange capacity

**“Pseudo-total” Metals:**
- aqua regia extraction and ICP detection: Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, V, Zn, Fe, Al
- aqua regia extraction, derivatization e ICP hydrides detection: Sb, As, Se, Sn
- elemental analysis (AMA): Hg
ALL ANALYSIS WERE PERFORMED BY ARPAV LABORATORIES

- Laboratories Service of Treviso, Chemical Unit
- Until 2009 at Castelfranco Veneto site,
- From 2010 at new ARPAV site in Treviso
- Accredited by SINAL (now Accredia) since 1993
- By 1992 it performs ISE (Int. Soil Exchange) ring test organized by WEPAL, Wageningen Universityt (NL)
DATA PROCESSING

Statistical analysis of data was worked out for each depositional unit.

Some descriptive statistics were performed for each item, keeping separate values of the topsoil from deeper horizons.

For each variable were determined: mean, median, minimum, maximum, some percentiles (5th, 25th, 75th, 90th and 95th), standard deviation, standard error, skewness and kurtosis, normality tests.

95° percentile is assumed as background values

_LOWER LAYER \rightarrow PEDO-GEO BACKGROUND
_UPPER LAYER \rightarrow BACKGROUND

THE HIGHER OF THESE TWO VALUES IS ASSUMED AS BACKGROUND LEVEL ACCORDING TO ITALIAN ENVIRONMENTAL CODE
DEPOSITIONAL UNITS

DEPOSITIONAL UNITS

PO ADIGE BRENTA PIAVE

TAGLIAMENTO

ADIGE BRENTA PIAVE

PO

Unità deposizionali

T  P  B  A  O  MC1  MC2  MV1  MV2  DP  DA
# BACKGROUND VALUES

<table>
<thead>
<tr>
<th>Depositional Units</th>
<th>Sb</th>
<th>As</th>
<th>Be</th>
<th>Cd</th>
<th>Co</th>
<th>Cr</th>
<th>Hg</th>
<th>Ni</th>
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<td>nd</td>
<td>14</td>
<td>nd</td>
<td>0.62</td>
<td>12</td>
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<tr>
<td>Piave</td>
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<tr>
<td>Brenta</td>
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<td>45</td>
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<td>0.95</td>
<td>16</td>
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<td>153</td>
<td>0.08</td>
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</tr>
</tbody>
</table>
MAIN RESULTS

With respect to residential area limits stated by Italian Environmental Code:

• for few elements BV never exceed limits: antimony, cadmium, mercury, lead and selenium

• for some BV have few exceedings: copper (Piave),

• for many BV exceeds limits in many units: arsenic, berillium, cobalt, cromium, nickel, vanadium, zinc

• for one BV exceeds limit in all units: tin
ARSENIC

Background values

- 0 - 13 mg/kg
- 13 - 20 mg/kg
- 20 - 27 mg/kg
- > 27 mg/kg
NICKEL

Background values

- 0-80 mg/kg
- 80-120 mg/kg
- 120-160 mg/kg
- >160 mg/kg
COPPER

Background values
Thank you for your attention