Urban Mining: Recycling – or more?

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Content

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- Why urban mining?
- Four elements of an urban mining strategy
- Urban mining and re-industrializing the city
- Summary
What is urban mining?

Systematic, goal oriented management of anthropogenic resource stocks in view of:
- long-term environmental protection
- resource conservation
- economic benefits
Why urban mining?  

Environmental protection

Environmental degradation by mining

Environmental burdens by primary production
Why urban mining?

large resource stocks

Fossil fuels
Construct. materials & consumer goods
Water

Air
Off-gas
Sewage

Export goods
Solid wastes
Municipal solid wastes

Stock: 350 + 7

$\Sigma_1 \sim 200 \text{ t/c.y}$

$\Sigma_0 \sim 195 \text{ t/c.y}$

Source: Daxbeck et al. 1996 (updated)
Why urban mining?

large resource stocks

plastic flows in Austria 1994 [in kt/year]

Source: R. Fehringer, 1998
Why urban mining?

resource conservation

Iron flows through Austria

Iron flows through Austria

- primary production
- production
- consumpt
- waste magment
- other disposal
- pedo-/lithosphere

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# The 4 elements of an urban mining strategy

<table>
<thead>
<tr>
<th>Topic</th>
<th>Actor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design for Urban Mining</td>
<td>industry &amp; academia</td>
</tr>
<tr>
<td>2. New knowledge base:</td>
<td>public -&gt; private sector</td>
</tr>
<tr>
<td>• Urban prospection methodology</td>
<td>public &amp; private sector</td>
</tr>
<tr>
<td>• Resource cadastre</td>
<td>public sector</td>
</tr>
<tr>
<td>3. High-Technology logistics, separation, and recovery processes</td>
<td>industry &amp; academia</td>
</tr>
<tr>
<td>4. Final sinks for the „useless“</td>
<td>public &amp; private sector</td>
</tr>
</tbody>
</table>
The 4 elements of an urban mining strategy

1. Design for Urban Mining: example lead

available stock [tons]

market price

[0, cost for recovery /ton]

lead accumulators

water pipes

inhouse

telecom cable

power cable

sewer pipes

source: Lohm et al., 1998
The 4 elements of an urban mining strategy

1. Design for Urban Mining: example copper
The 5 elements of an urban mining strategy

1. Design for Urban Mining
2. New knowledge base: Resource cadastre
New knowledge base: the case of aluminum

aluminum in packaging wastes:

1.9 kg/c.year

= 3 % of total Al-turnover
New knowledge base: the case of Vienna

[kg/capita]

Vienna stock in use and hybernating

<table>
<thead>
<tr>
<th>Element</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>200 kg</td>
</tr>
<tr>
<td>Iron</td>
<td>5,000 kg</td>
</tr>
</tbody>
</table>

Stock in Vienna landfills

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<th>Amount</th>
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<tr>
<td>Lead</td>
<td>20 kg</td>
</tr>
<tr>
<td>Iron</td>
<td>350 kg</td>
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</tbody>
</table>

Source: R. Obernosterer et al, 1998
The 4 elements of an urban mining strategy

1. Design for Urban Mining

2. New knowledge base: Resource cadastre and

   Urban prospection (analogon to geophysical prospection)
   - Concentration [mass per mass]
   - Density [mass per area]
   - Total mass of substance
   - Speciation
   - Other constituents
   - Costs of exploitation
   - others
The 4 elements of an urban mining strategy

1. Design for Urban Mining
2. New knowledge base
3. High-Tech logistics, separation, and recovery processes
High-Tech logistics and recovery processes

from MSW to material resources
by means of MSW incineration
High-Tech logistics and recovery processes

from Morf & Böni, 2011
The 4 elements of an urban mining strategy

1. Design for Urban Mining
2. New knowledge base
3. High-Tech logistics, separation, and recovery processes
4. Final sinks for the „useless“
Not all flows go in cycles -> need for sinks!

corrosion & weathering

consumption emissions (CO₂ et al.)

sewage

solid waste

recycling
The sinks on planet earth are limited

Atmosphere 4.200 [Mio. km³]

Hydrosphere 1.400 [Mio. km³]

Pedosphere 0.3 [Mio. km³]

After A. Nieman supplemented by G. Döberl
Summary

1. Goal of urban mining:
   - resource conservation and environmental protection
   - economic benefits

2. Reason for urban mining:
   - large anthropogenic stocks (larger than geogenic stocks?)

3. Challenges:
   - new knowledge base
   - new design for “urban mining”
   - new technologies
     - urban prospection
     - high-tech separation processes (*clean cycles!*)
   - economics of secondary versus primary resource use
   - demand for final sinks!
Thank you
Stock dynamics and waste generation

Input of solid materials into use

Output of solid materials from use (wastes)

Mean residence time of materials

waste today

waste in 40 years
Urban mining and re-industrializing the city

Coupling materials and energy by MSW incineration

from Morf & Böni, 2011