

## Raw material

### Your recyclables are important to us

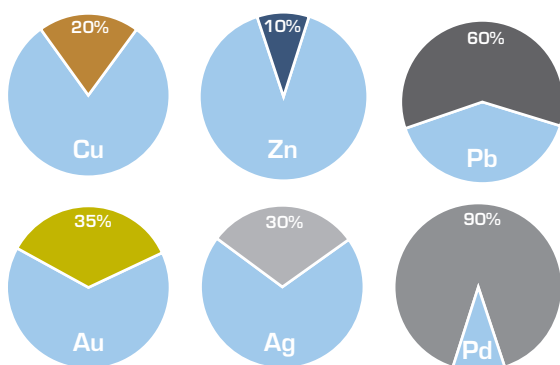
The majority of raw materials processed at Boliden's smelters are mineral concentrates from mines. However, a significant proportion of metal production also comes from recycling secondary materials. From these materials, we recover everything from copper, zinc and lead to gold, silver, platinum, palladium, nickel, selenium and cobalt.

The recovery of metals has played a significant role in Boliden's supply of raw materials since the 1930s. The amount of recovered metal is steadily increasing.

### Capacity, efficiency and expertise to benefit you and the environment

Constant process development and the use of the latest purification technology has put Boliden streets ahead when it comes to adapting smelters and creating the flexibility to accommodate the recyclables on the market. Our large-scale and efficient processes mean that we can recover a range of valuable metals from many different types of secondary raw material. The high level of purification in our processes also makes Boliden's recycling extremely competitive from an environmental perspective. With our metals, the level of recovery is almost 100%, while all plastics are used as a reducing agent and fuel in the smelting process.

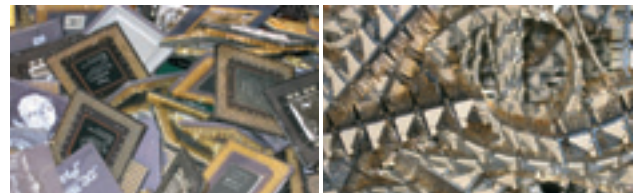
### Boliden's recycling as proportion of total metal production



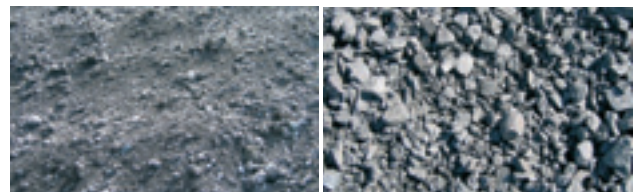
**Circuit boards**  
cap: 50 000 mt



**Metal shred/Bullion**  
cap: 40 000 mt



**Components/Metal Alloy**  
cap: 20 000 mt



**Slag/Slime/EAF dust**  
cap: 150 000 mt



**Your recyclable**

**The main features of Boliden's recycling are:**

- The Rönnskär Cu-Pb-Zn-PM smelter and refinery
- The Harjavalta Cu-Ni-Co-PM smelter and refinery
- The Kokkola Zn smelter
- The Odda Zn smelter
- The Bergsöe Pb smelter and refinery
- The Boliden ore concentrator

Boliden's recovery operation is a complete and flexible system involving all our smelters working together. The integration strengthens old recycling paths and offers opportunities for new ones. To understand this we need to dig deeper into the flow sheet and note the following niches due to specialised processes and knowledge:

- The Fuming process for the recovery of Zn from slags and EAF dust
- The Electric furnace for the smelting of inert secondary raw materials
- The KALDO process for the treatment of electronic scrap
- The Nickel Flash smelter and Electric furnace for residues
- The Shaft furnace for the recovery of waste lead batteries
- The Zinc purification plant adapted for the extraction of zinc from recycled oxides and copper containing feed

This can be translated into the large variety of raw materials that are accepted as feed. It also translates into a variety of products with the same high purity, independent of the source of feed, thus adding value.

Table 1 : Recycling chain illustrated by examples

| Feed                 | Products extracted  | Processes used  | Sites involved                      |
|----------------------|---|---|-------------------------------------|
| Copper zinc ashes    | Cu, Zn, Ni,   | EF, Fuming, RLE   | Rönnskär, Odda                      |
| Copper scrap         | Cu, Au, Ag,   | Converter, El refining, PM Kaldo  | Harjavalta, Rönnskär                |
| Alloy scrap          | Cu, Ni, Ag, Au, Co  | Converter, El refining, PM Kaldo  | Harjavalta, Rönnskär                |
| EAF dust             | Zn, Iron sand   | Fuming  | Rönnskär, Odda                      |
| Electronic scrap     | Cu, Au, Ag, Ni, Se, Te, Sb, Pt, Pd, Zn, iron sand, energy | KALDO, Converter, El refining, PM plant, Fuming plant, Shaft furnace, Flash | Rönnskär, Odda, Bergsöe, Harjavalta |
| Copper Zinc residues | Zn, Cu,   | RLE, Converter, El Refining   | Kokkola, Harjavalta, Odda, Rönnskär |
| Lead cables          | Pb, Cu, iron sand   | Lead refinery, Converter, El refining                                       | Rönnskär                            |
| Industrial catalysts | PM, Cu, Zn, Ni,   | EF, Converter, Fuming, El refining, PM plant                                | Rönnskär, Harjavalta, Odda          |

| Recycling at Boliden |                   |                  |                       |
|----------------------|-------------------|------------------|-----------------------|
| Alloy scrap          | Copper scrap      | EAF dust         | Secondary concentrate |
| Ashes                | Copper wire       | Electronic scrap | Si bearings           |
| Brass residue        | Cu / PM dust      | Fines            | Skimmings             |
| Catalysts            | Cu / PM slime     | Ingots           | Slag                  |
| Chopped wire         | Cu Ni scrap       | Pastes           | Sweeps                |
| Circuit board trim   | Cu reverts        | Pb batteries     | Turnings              |
| Circuit boards       | Cu scale          | Pb cable         | Zn residues           |
| Clip                 | CuSO <sub>4</sub> | Pb residues      | Zn reverts            |
|                      | Drosses           | PM residues      | ZnO                   |