

# RECHARGEABLE LITHIUM IONS BATTERIES



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WHY WE SHOULD  
RECYCLE THEM ?

## WHAT ARE THEY USED FOR ?

- ▶ Used for their excellent capacity
- ▶ Integrated in smartphones, computers and cameras
- ▶ Worn by Mercedes Benz Company for the air conditioning system
- ▶ Employed in electric cars prototypes especially from Tesla Motors.



### HOW ABOUT THEIR STORIES ?

- ▶ The first type of lithium battery was the button cells, used for watches, cameras, calculators, remote controls, and for surgical implants, like pacemakers, and other objects of that type.
- ▶ It was Professor John Goodenough who first demonstrated that lithium cobalt oxide could be used to create a rechargeable battery capable of storing energy back in 1979.
- ▶ In 1991, Sony added a graphite anode to the batteries to produce and market them.
- ▶ Since then, the batteries have been improved to keep more charge and to be more durable



# WHAT ARE LITHIUM RECHARGEABLE BATTERIES MADE OF ?

### ► Cobalt :

- Used for the cathode
- Mined in Congo, China and Canada
- Raw material used as lithium cobalt oxide
- Could be replaced with manganese oxide, iron phosphate and rarely with graphite





# LITHIUM BATTERIES

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## ▶ Graphite :

- Used for anode
- Worn as well for its low voltage and excellent performance

## ▶ Lithium ions :

- Produced by electrolysis reactions
- Mined in China and Australia
- Discovered in Sweden
- Main component of this type of batteries



## ► **Copper :**

- Used because of its high conductivity; copper foil separates anode from cathode
- Mined in Chile, Utah (USA), Indonesia and Peru
- Reserves of copper, currently in use, and that can be used by people, will only last from 25 to 60 year from now



# HOW THEY CAN BE RECYCLED ?



## LITHIUM BATTERIES

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- ▶ Lithium batteries are recycled abroad (France, Germany, USA, Belgium)
- ▶ Recycling them is important because they are made up of cobalt and graphite, that are REE, and copper and lithium, that are also not so abundant on Earth.
- ▶ To recycle the batteries we have to:
  - Deactivate them
  - Their system has to be disassembled
  - The materials have to be sorted
  - Metals can be recycled in ovens by a pyrometallurgical system or a hydrometallurgical system

This isn't a very widespread method, because it's expensive and disadvantageous for the high price of the treatment. Especially lithium often isn't recycled at all, because its recycling costs are much higher than those of its extraction.



**IN NATURE REDUNDANT MATERIAL (GENOMIC) IS HARDLY EVER GARBAGE, THAT IS WASTE AND IT'S THROWN AWAY, BUT ALMOST ALWAYS JUNK; JUNK OR SCRAP METAL READY TO BE REINTERPRETED AND REUSED. REUSE IS NOT A MARGINAL STRATEGY, BUT A HIGHWAY OF BIOLOGICAL EVOLUTION.**

Stephen Jay Gould