

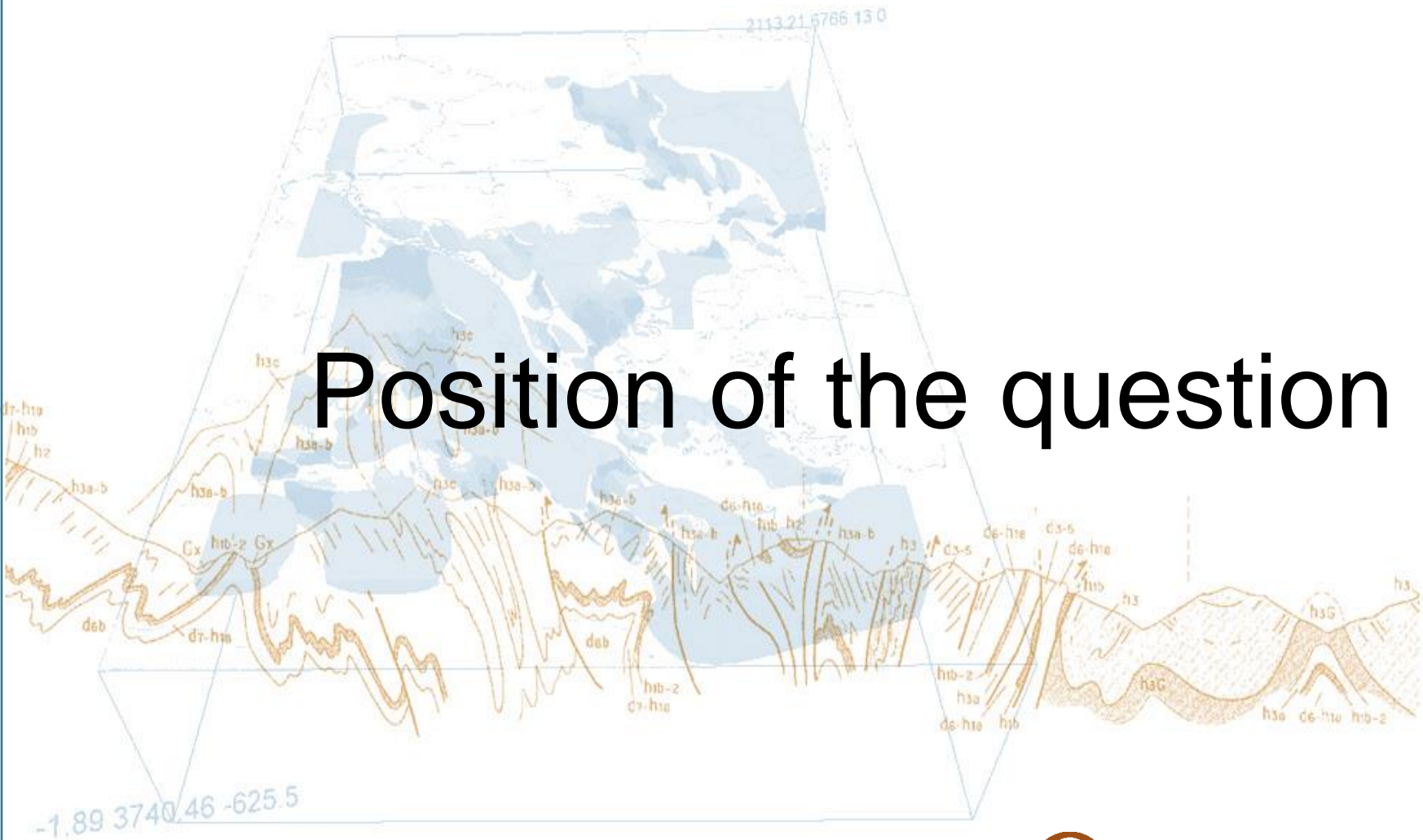


# LCA/RMF/MFA

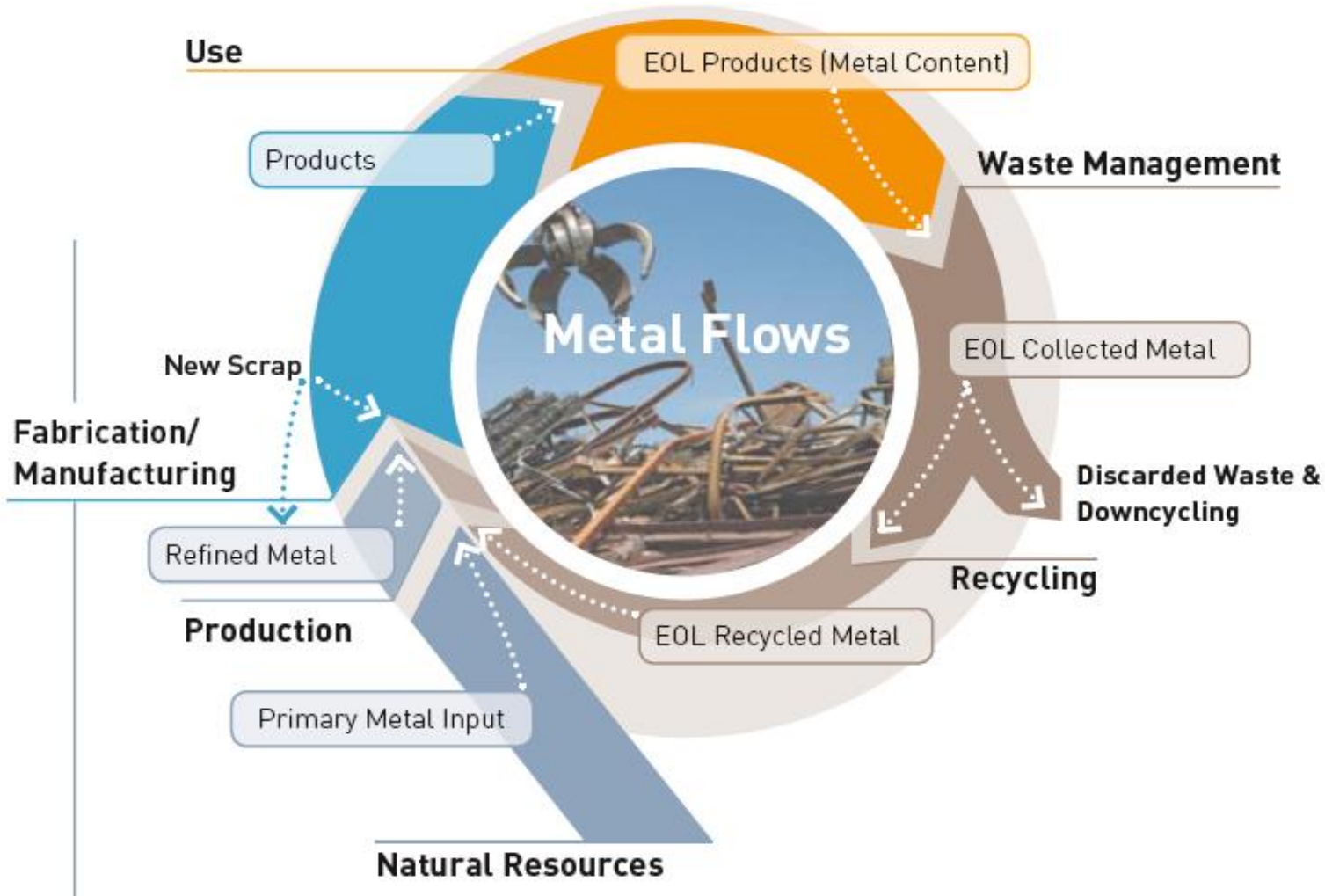
Some elements



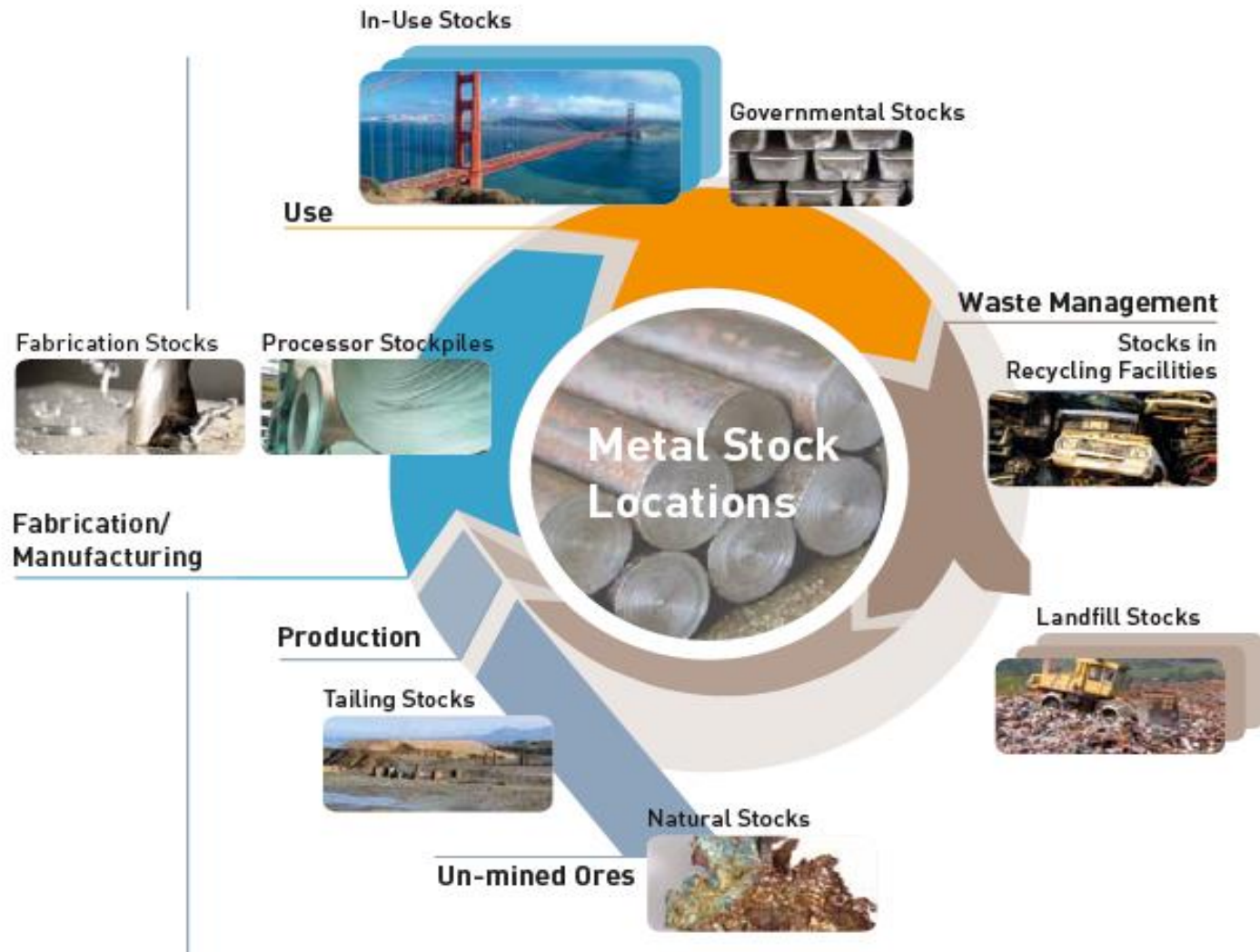
# Position of the question



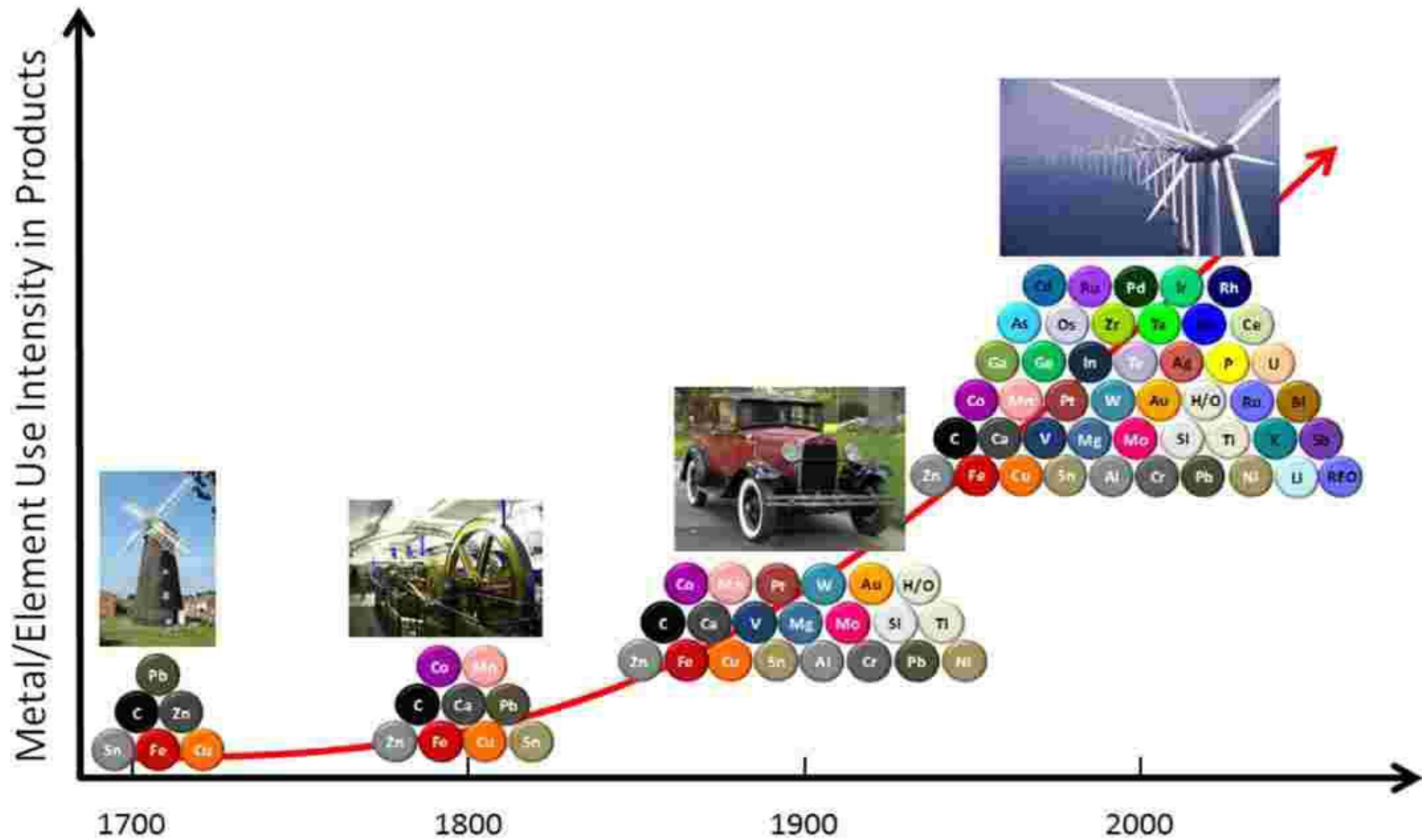
# The metals cycles



# The metals stocks



# Increased interlinkage of metals in products



# Stakes (cf. Raw Materials Initiative)

## > **A method for mapping flows and stocks (generalised MFA)**

- Where (products, economic activity) ?
- When?
- Quantities?
- Impacts?

## > **A model to predict “urban resources” for**

- Better assessing metals policies at national/industrial level
- Securing the supply to industries
- Managing stocks and waste
- Properly accounting for environmental impacts



# Examples of EU projects



# EURARE



- > Funding Scheme: Large-scale integrating collaborative project.**
- > FP7 NMP Work Program 2012:  
NMP.2012.4.1-1 New environmentally friendly approaches in minerals processing**
- > Total budget: 13.8 M€**
- > EC contribution: 9 M€**
- > 21 partners, 10 countries**
- > Coordinator National Technical University of Athens (NTUA) (Ioannis Paspaliaris)**
- > Start date: 1.2.2013**



# EURARE objectives

- > The main goal of EURARE proposal is to set the basis for the development of a European REE industry that will safeguard the uninterrupted supply of REE raw materials and products to crucial for the EU economy industrial sectors.**

# EURARE consortium

## **COORDINATOR**

- NATIONAL TECHNICAL UNIVERSITY OF ATHENS

## **4 MINING COMPANIES**

- TASMET AB
- GREENLAND MINERALS AND ENERGY (TRADING) A/S
- TANBREEZ MINING GREENLAND A/S
- FEN MINERALS AS

## **7 GEOLOGICAL SURVEYS**

- GEOLOGIAN TUTKIMUSKESKUS
- INSTITUTO GEOLOGIKON KAI METALLEYTIKON EREYNON
- SVERIGES GEOLOGISKA UNDERSÖKNING
- GEOLOGICAL SURVEY OF NORWAY
- GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
- BRGM - France
- NATURAL ENVIRONMENT RESEARCH COUNCIL

## **4 UNIVERSITIES INCL. NTUA**

- RHEINISCH-WESTFÄHLISCHE TECHNISCHE HOCHSCHULE AACHEN
- KATHOLIKE UNIVERSITEIT LEUVEN
- SVERIGES LANTBRUKSUNIVERSITET

## **8 INDUSTRY AND RESEARCH INSTITUTIONS**

- OUTOTEC OY
- MEAB CHEMIE TECHNIK GMBH
- D´APPOLONIA SPA
- ALOUMINION AE
- LESS COMMON METALS LTD
- NEOREM MAGNETS OY
- JOHNSON MATTHEY PLC
- KEMAKTA AB

## **INDUSTRIAL ADVISORY BOARD (NOT PARTNERS)**

- NOKIA OYJ
- RENAULT
- HEWLETT-PACKARD GMBH
- UMICORE
- TREIBACHER INDUSTRIE AG
- ETP SMR

# Minerals4EU

- > Minerals Intelligence Network for Europe**
- > Funding scheme: FP7-NMP-2013-CSA-7;  
Coordination and support actions  
(Coordinating)**
- > Work program topics addressed:  
NMP.2013.4.1-3 (European Intelligence  
Network on the Supply of Raw Materials)**
- > EC funding: 2 M€**
- > 31 partners, 23 countries**
- > Start date end 2013**

# Minerals4EU objectives

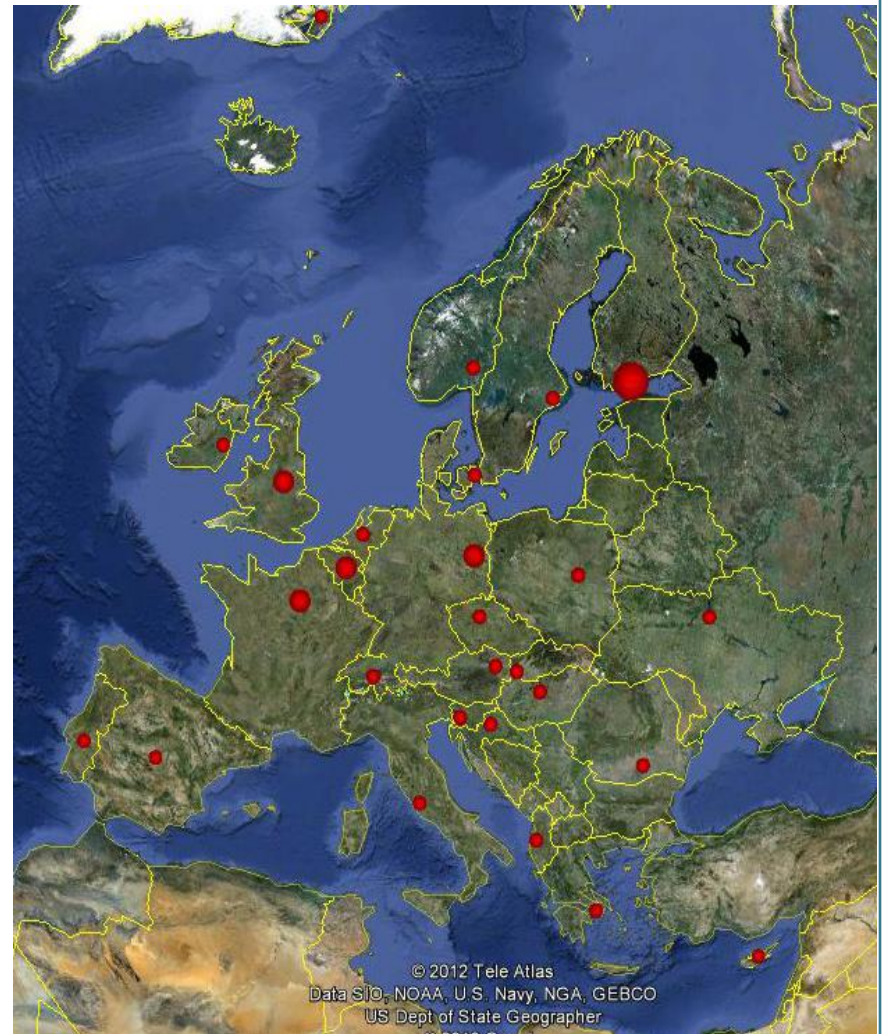
- > The main objective of Minerals4EU project is to develop an EU Mineral intelligence network structure model.**
- > EU minerals intelligence network structure, comprising the most directly involved public regional, national and European minerals data providers and stakeholders,**

# Minerals4EU objectives

- > Create a sustainable network gathering a critical mass of institutions with the relevant authority and competencies at world, EU and national levels, resulting in the creation of a permanent body before the end of the project.**
- > INSPIRE compatible infrastructure (Integrated Knowledge Management System) that enables partners to share mineral knowledge, and the public and private stakeholders to find, view and acquire standardized and harmonized information.**

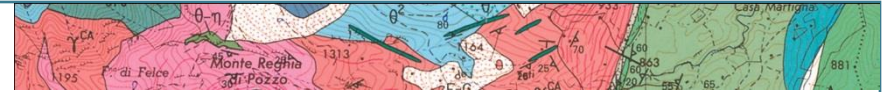
# Minerals4EU objectives

- > **Minerals4EU aims to become the leading European mineral information network structure that will provide tools and expertise to enhance resource efficiency, minerals supply security and support sustainable minerals development for Europe**

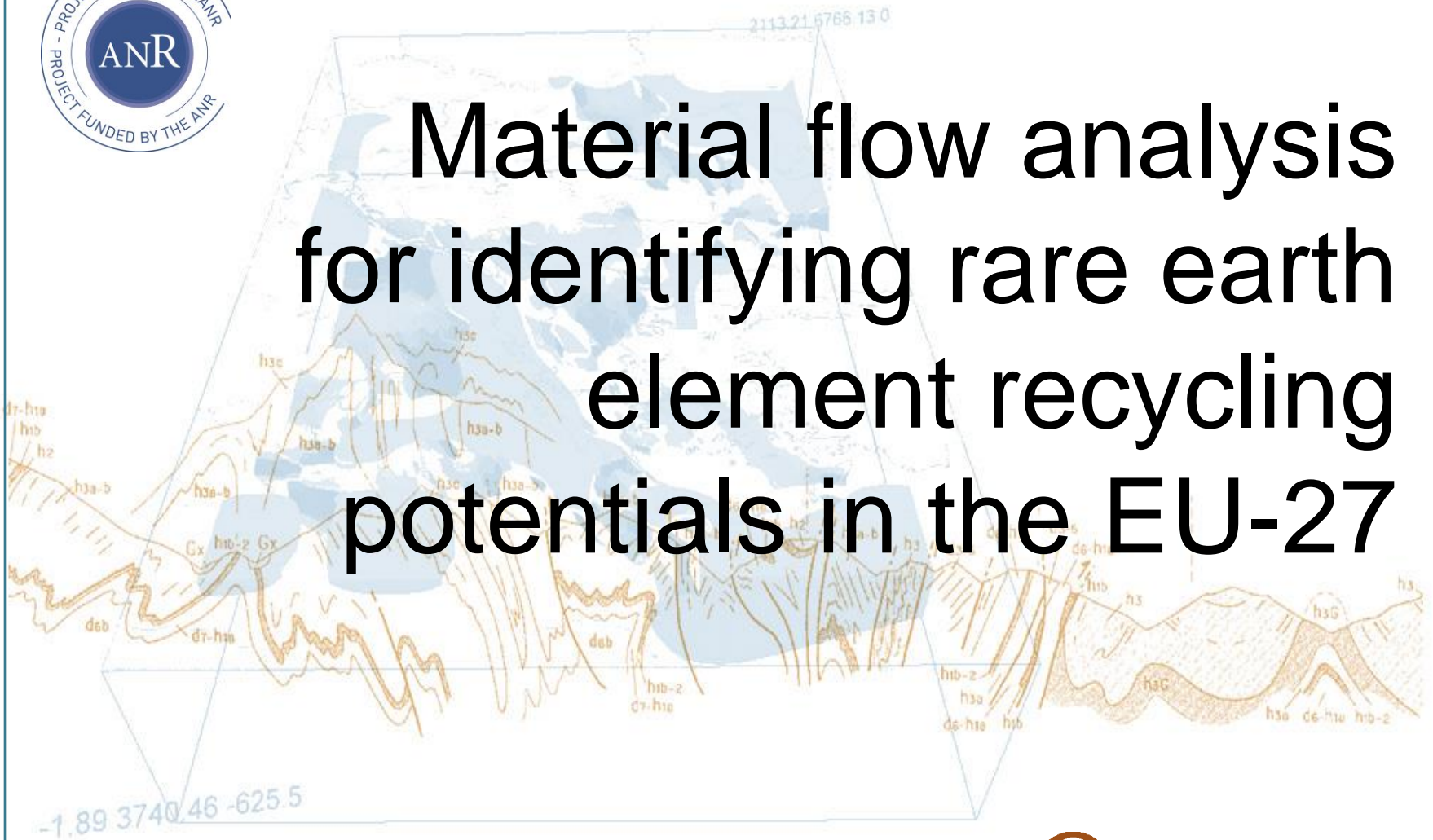


# Minerals4EU consortium

- **GEOLOGIAN TUTKIMUSKESKUS**
- **EUROGEOSURVEYS - EGS**
- **SELOR eeig**
- **Institut Royal des Sciences Naturelles de Belgique**
- **Natural Environment Research Council**
- **BRGM - France**
- **Bundesanstalt fuer Geowissenschaften und Rohstoffe**
- **Ceska Geologicka Sluzba**
- **Geologische Bundesanstalt**
- **Geoloski Zavod Slovenije**
- **The Geological Survey of Denmark and Greenland**
- **Institutul Geologic al Romaniei**
- **Department of Communications, Energy and Natural Resources**
- **Instituto Geológico y Minero De España**
- **Ethniko Kentro Viosimis kai Aeiforou Anaptyxis**
- **Istituto Superiore per la Protezione e la Ricerca Ambientale**
- **Laboratorio Nacional de Energia e Geologia I.P.**
- **Magyar Foldtani és Geofizikai Intezet**
- **Geological Survey of Norway**
- **Panstwowy Instytut Geologiczny - Panstwowy Instytut Badawczy**
- **State Geological and Subsurface Survey of Ukraine**
- **Statny Geologicky Ustav Dionyza Stura**
- **Sveriges Geologiska Undersokning**
- **Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek - Tno**
- **Wuppertal Institute for Climate, Environment and Energy**
- **Hrvatski Geološki Institut**
- **Joint Research Centre JRC**
- **Fraunhofer -Institut für System- und Innovationsforschung (ISI)**
- **Swiss Geological Survey Federal office of topography swisstopo**
- **Geological Survey Department GSD**
- **Sherbimi Gjeologjik Shqiptar AGS**



# Material flow analysis for identifying rare earth element recycling potentials in the EU-27





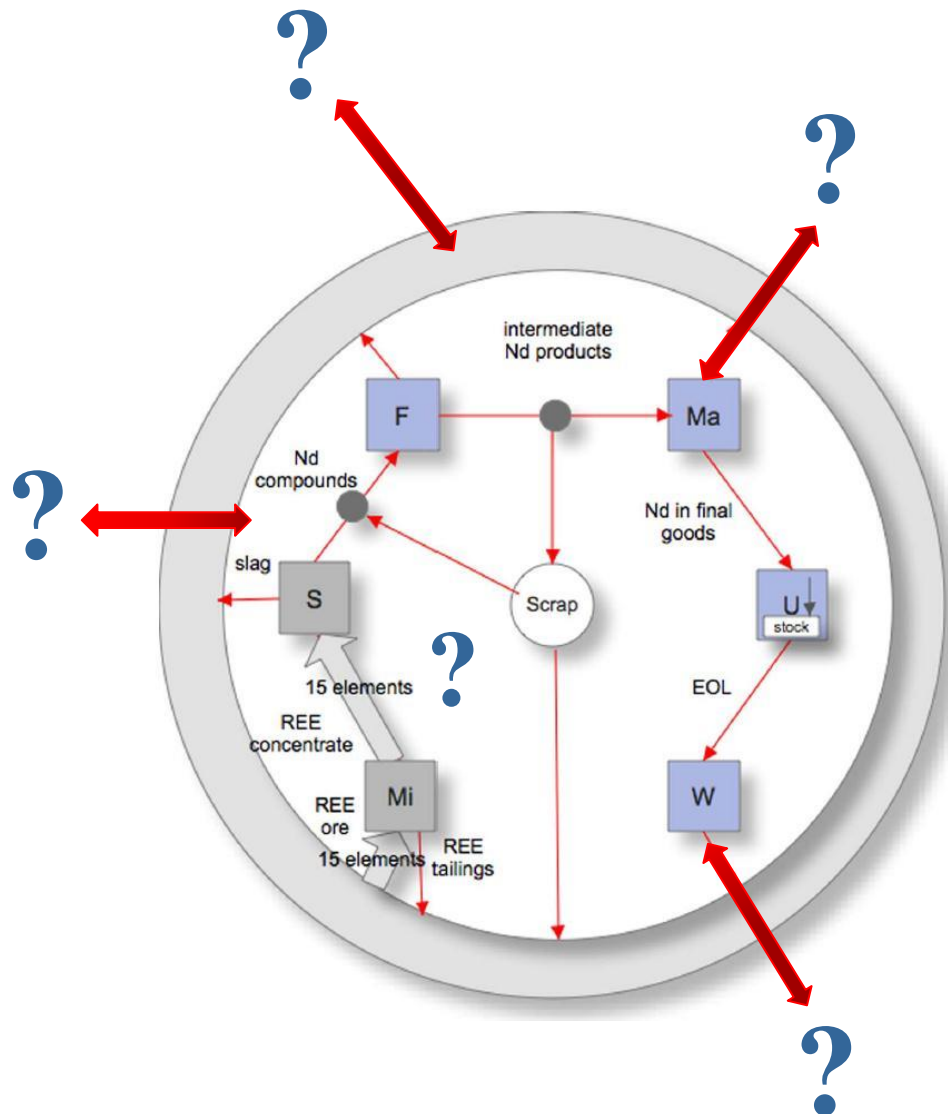
# Objectives

- > Systemic Analysis of Rare Earth Elements – flows and stocks**
- > Explore, using MFA, flows and stocks of certain (heavy) rare earth elements (REEs) at the scale of the EU-27**
- > Started: January 2012, 3-year project**
- > Build Sankey diagrams to help visualize flow and stocks and better appreciate their criticality and recycling potentials**

# MFA and uncertainty

Although flows and stocks in Sankey diagrams are often represented by precise numbers, these numbers are affected by significant uncertainty

*Modified after  
Du & Graedel,  
2011*



# Examples of sources of uncertainties

- Estimating the quantities of REE in a component (e.g. Nd in a permanent magnet) and also quantity of component in a product (wind turbine, hybrid car, audio appliance, etc...)
- Illegal exports (e.g. China for REOs)
- Losses in industrial processes
- When using databases such as EUROSTAT or WTA: interpretation of customs data (ProdCom or SH codes)
- Member state decisions regarding reporting of imports and exports of rare earth compounds (Austria doesn't report since 2008)
- Errors in customs data capture
- ...

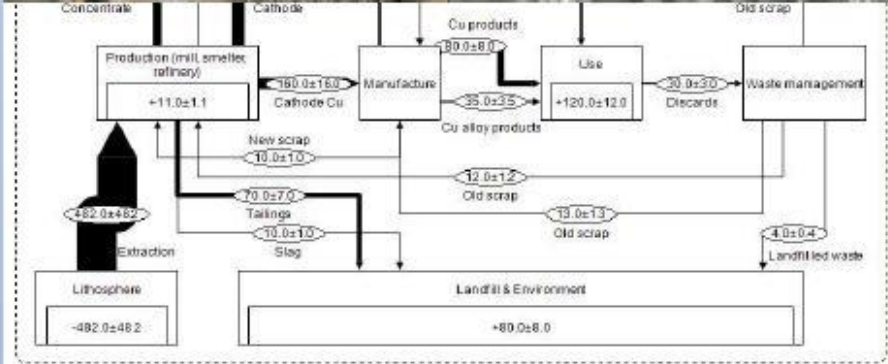
# International Workshop



## Data reconciliation and uncertainty in process and material flow analyses

Paris, March 20<sup>th</sup>, 2014

- What methods are currently used to reconcile uncertain data in process and material flow analyses?
- What are the pros and cons of stochastic methods and are there alternative approaches?
- How can recent methods based on fuzzy constraint reconciliation serve the needs of industry?





# A proposal from the French Ministry of Industry



# International Metal Study Group

- > Copper, nickel, lead and zinc**
- > intergovernmental organizations**
- > increase market transparency and promote international discussions and cooperation on issues related to 4 base metals**
- > Study to improve knowledge of the whole value chain**
- > Meet twice a year in April and October**

# Lead and Zinc: ILZSG

- > Formed by the United Nations in 1959**
- > European members : BE, BG, DE, EU, FI, FR, IE, IT, NL, PL, PT, SW.**
- > US member**
- > Budget for 2013: 373 k€**

# Nickel: INSG

- > Created in 1990**
- > European Members : DE, EU, FI, FR, IT, PT, SW, UK.**
- > US no member**
- > Budget for 2013 : 341 k€**



# Copper: ICSG

- > Created in 1992**
- > European Members : BE, DE, EL, ES, EU, FI, FR, IT, PL, PT, SW, UK.**
- > US member**
- > Budget for 2013 : 460 k€**

# The by-product subject

- > 2012 → study of by-product metals of copper, lead, zinc and nickel by the UK consulting firm Oakdene Hollins**
- > April 2013 vote other studies → on going common ICSG/INSG study on by-product cobalt & ILZSG study on by-product indium.**
- > October 2013 : joint seminar on by by-products of Cu, Ni,Pb and Zn including their role as critical materials**

# Joint seminar gives possible directions

- > Publish freely some studies (for the moment it is necessary to pay)**
- > Evolution of the mandate of the groups to include in their scope the by and co-products**
- > Action → EU-US note ?**



There is a continuous need on **information** on metal flows and of international **exchanges...**



**Thank you!**