

## BRIEFCASE

### Learning the uses of minerals through non-conventional teaching tools

#### D.3.1- BRIEFCASE TOOLKIT\_ V0

##### PROJECT DOCUMENTATION SHEET

<b>Proposal Acronym</b>	BRIEFCASE
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# Content

PROJECT DOCUMENTATION SHEET .....	1
DELIVERABLE DOCUMENTATION SHEET .....	2
CHANGE HISTORY .....	2
DISTRIBUTION LIST .....	2
1. OVERVIEW OF THE DELIVERABLE .....	4
2. ORIGINAL BRIEFCASE CONTENT .....	5
2.1. THE PHYSICAL BRIEFCASE .....	5
2.2. THE GAME “TEACHING PROCESS” .....	7
3. THE NEW BRIEFCASES .....	11
3.1. INTRODUCTION .....	11
3.2. THEMATIC BRIEFCASE: GOLD AND CONFLICT MINERALS .....	13
3.3. THEMATIC BRIEFCASE: TIN and Daily Life .....	16
3.4. THEMATIC BRIEFCASE: RECYCLING AND PLATINUM .....	19
3.5. THEMATIC BRIEFCASE: COBALT AND BATTERIES .....	23
3.6. THEMATIC BRIEFCASE: SECONDARY RAW MATERIALS .....	27
3.7. THEMATIC BRIEFCASE: NEW VERSION OF THE DAILY USES OF MINERALS .....	30
3.8. THEMATIC BRIEFCASE: THE PHONE MINERALS .....	33
4.- SUMMARY AND FOLLOWING STEPS: TOWARDS THE VIRTUAL BRIEFCASE .....	37
5. TRANSVERSAL GOLDPANING WORKSHOP .....	38

## 1. OVERVIEW OF THE DELIVERABLE

The BRIEFCASE is a mature and consolidated workshop, which has been applied for more than 10 years by the Geomining Museum<sup>1</sup>, in Madrid (Spain) focused on the diffusion of minerals knowledge among children during their visits to the Museum.

The workshop is aimed at identifying minerals and the ore elements that compose them and some everyday objects made with them. In this way, students guided by teachers, realize that many minerals are used in daily life. This workshop is a complementary activity to the curriculum of primary and secondary students. The problem that arises is that not all schools can include these workshops and that they are designated for a period of time. Therefore, one of the lines of work is that this type of teaching of the uses of the general subjects and objects that they compose are compulsory incorporated to the official and regulated subjects. The Geomining toolkit is the basis of the BRIEFCASE (physical and virtual) concept, but our Project covers much more fields and raise awareness about the mining sector, a concept that is new in this kind of workshops.

The aim of this document is to provide a general overview of the contents for the new physical briefcases' configuration. These guidelines are based on the conclusions of the deliverable "D.2 State of art" issued on April 2019, and also to create additional contents if it is required, assuring that the "sensible questions" are dealt and clearly communicated to each public target through the game and in the manuals.

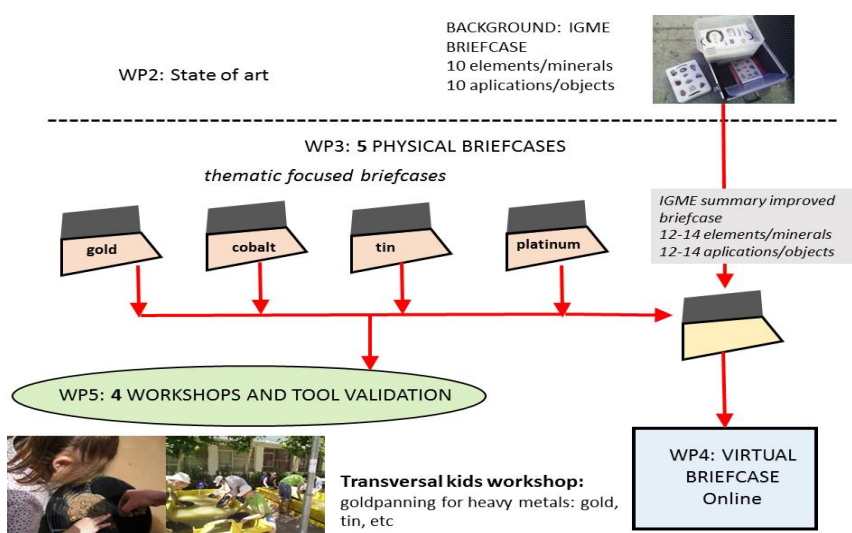


Figure 1: WP3 General scheme of the briefcase toolkit

<sup>1</sup> <http://www.igme.es/museo/didactica/maletasDid.htm>

## 2. ORIGINAL BRIEFCASE CONTENT

### 2.1. THE PHYSICAL BRIEFCASE

The IGME didactic suitcases include two 2 sets to make two teams that compete with each other guided by the teacher, with the following elements:

- 10 minerals: kyanite, cinnabar, sphalerite or blende, fluorite, galena, lepidolite, magnetite, malachite, wolframite and feldspar.
- 10 objects: a thermometer embedded in resin to prevent deterioration, a horseshoe, a coffee dish, a fishing line, a mobile battery, a zinc plate, a soda can, a light bulb, electrical cables and an empty tube of toothpaste. Each object is made with one element from one of the ore minerals,
- An hourglass that can be used to measure the time of each team in guessing the answers. This is left to the instructor's choice, but its use is recommended because it speeds up the development of the activity.
- A pen drive with a presentation to reinforce in class the knowledge acquired in the development of the workshop.
- 40 plasticized sheets with the necessary clues to relate the minerals to the objects (4 clues per mineral).
- A table that will serve to record the scores obtained by the two teams. We allocate scores obtained in each mineral searching
- A table with the solutions of the workshop.
- A sheet with the characteristics of the ten minerals included in the clues. They can be photocopied and handed to the student after the activity.



Figure 2: Briefcase toolkit of the Geomining Museum: the briefcase has 2 complete sets for 2 teams. Each set has one box with minerals and other with objects.



Figure 3: Briefcase toolkit elements of the Geomining Museum



## 2.2. THE GAME “TEACHING PROCESS”

Two teams of students and two instructors are established (they can be two teachers or two students).

The “original” suitcase (IGME consolidated workshop) had 10 minerals-elements and 10 objects-uses: things made with the ore elements of each mineral.

Mineral (box #1)	Element (search and find using clues)	Object (box #2)
Cinnabar	Mercury	Thermometer
Kyanite	Aluminium	Soda can
Sphalerite	Zinc	Galvanized steel
Fluorite	Fluor	Toothpaste
Galena	Lead	Plumb bob
Lepidolite	Lithium	Mobile phone battery
Magnetite	Iron	Horseshoe
Malachite	Copper	Wire
Orthoclase	Aluminium/potassium-Porcelain	Plate
Wolframite	Tungsten	Light bulb
Gold	Gold	Gold ring
Platinum	Platinum	Catalysator
Skutterudite	Cobalt	Cobalt blue
Cassiterite	Tin	Car toy

Table 1: Minerals and objects content in the IGME briefcase.



Figure 4: Summary photo of the minerals included in the workshop.



Figure 5: Summary photo of the products manufactured from the minerals in figure 4.

There are two complete sets, to make two teams that compete with each other guided by the teacher. The material is presented in two trays (not included in the suitcase): one with the minerals and another with the objects.





Figure 6: Image: kid fascinated with minerals and objects. The Geomining current Briefcase.

The previous image highlights the fascination that minerals show on kids. This workshop, with the appropriate guidance of the moderator can be from Young kids to secondary school and even anybody. In the case of very young kids they need focused guidance otherwise the workshop can become chaotic with children **playing nonsense** with all minerals and tools. The must proceed mineral by mineral an object by object filling down the punctuation chart. See image below:



Figure 7: Image: minerals arranged following identification. See the punctuation chart

Each group will have approximately 45 minutes to solve the game and then 15 minutes of summary of the class by the teacher with a presentation on the minerals seen and their applications

**See video the following video explaining: in 2 parts**

<https://www.youtube.com/watch?v=NaKmCp-55k&t=3s>

<https://www.youtube.com/watch?v=NaKmCp-55k>

A presentation of the Briefcase can be found through the following links. First one with subtitles in several languages.

<https://www.youtube.com/watch?v=JYQ1XuFLTPo&t=3s>

<https://www.youtube.com/watch?v=na9AxhprAiY&t=31s>

<https://www.youtube.com/watch?v=-nxmkeaamdc>

The way to “play” with the toolkit, the workshop schema and guide will be developed along the following deliverables of the project (D.3.3 and D.3.4).

### 3. THE NEW BRIEFCASES

#### 3.1. INTRODUCTION

During the previous deliverable "state of art" several thematic minerals of relevance were decided, from which sheets or profiles were elaborated, which were:

- Gold
- Diamond
- Cobalt
- Tungsten
- Tin
- Platinum group elements

According to the project Business Plan, six (4 in the original proposal +2 in the fast track) new didactic would be developed in addition to updating and translating the existing one in the IGME to Slovenian. The new thematic suitcases, selected from the previous profiles, were:

- Gold
- Cobalt
- Tin
- Platinum

As a lesson learnt, we have checked that pupils are fascinated by mobile phones, and to increase their attention during the workshops, a thematic briefcase about the minerals in the phone has been developed.

In addition, we detected that the pupils don't know what happens with the residues once we deposit in the containers and in order to reinforce the recycling message and address their behaviour, a thematic briefcase about the secondary raw materials has been created.

Specific targets of all the Briefcase toolkit are the following:

- Improve the perception of the mining activities
- Importance of our purchase decisions
- Recycling practices
- Responsible consumption

- Climate change action
- Highlight the career opportunities in mining

The Briefcase Games will highlight other SDG goals as mining companies will be called on to extract with responsibility, produce with less waste, use safer processes, incorporate new sustainable technologies and promote the improved wellbeing of local communities among others commitment to the SDGs. The consortium will refer to the document *Mapping Mining to the Sustainable Development Goals: An Atlas*<sup>2</sup> to define the BRIEFCASE specific contributions during the Didactic Guides development.

The Briefcase idea intends to create awareness about sensible matters regarding with mining activities and sensible question regarding with these activities. **The methodology will show how the sensible questions are tackled through the sheets of the game to get a positive response from the pupils in terms of costumes and behaviour.**

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<sup>2</sup>[https://www.undp.org/content/dam/undp/library/Sustainable%20Development/Extractives/Mapping\\_Mining\\_SDGs\\_An\\_Atlas\\_Executive\\_Summary\\_FINAL.pdf](https://www.undp.org/content/dam/undp/library/Sustainable%20Development/Extractives/Mapping_Mining_SDGs_An_Atlas_Executive_Summary_FINAL.pdf)

### 3.2. THEMATIC BRIEFCASE: GOLD AND CONFLICT MINERALS

The Gold Thematic Briefcase toolkit is focused on the rethinking about the Gold perception, making students aware of conflict gold exploitation. Currently, gold mining is a global business with operations on every continent, except Antarctica. In case of artisanal mining and under current socio-economic and political conditions in developing countries, mercury-based gold mining is the easiest and the cheapest way of obtaining this metal, but highly unsafe and unhealthy.

In the project workshop with schools the double face of Gold will be showed: being “strategic mineral” historically used for the empires’ fortunes and, at the same time, being a mineral, whose extraction and processing raises complex social, moral and ecological problems.

What’s behind the apparent “beauty” and “pureness” of Gold?

#### **Gold Briefcase Game**

The workshop plays on the change of perspective and it is constructed on the story of an imaginary pirate searching a treasure. The pirate, with this Briefcase, starts the journey in order to know more on Gold. In this collective journey of four stop-over (extraction, processing, commercialisation, recycling) students will discover the social life of the mineral. In each stop there is a specific activity for them with different educational goals. Each phase should last the same time but the teachers knowing better the students and they can manage the activities as they see fit. At the end of the story, the pirate will be awarded with a golden metal that will be the starting-point object to encourage the reflexion on the social and cultural meanings attributed to the gold, like beauty, power and value.

The activities for the younger pupils are more focused on extraction and recycle, while the activities for the older more on the conflict gold exploitation. The use of collective narrative is a learning tool to familiarise students on the complexity circuit of gold.

#### **Educational goals - learning by playing**

- Rethinking about the gold perception.
- Learn more about the global business of gold mining.
- Encouraging to think about social and cultural meanings historically assigned to Gold.
- Making older pupils aware of the invisible supply chain of extraction, processing, commercialisation and sale of gold.

- Learn more about the consequences of mining operations in terms of social and environmental impacts, especially in developing countries.
- Reflecting on possible solutions addressing the social consequences produced by the conflict gold exploitation (purchase decisions).
- Raising awareness of the importance of recycling.
- Learn more about the mineral gold, its uses and mining conditions.

How gold is historically mined will be part of a transversal goldpanning workshop.

#### **The Gold Briefcase contents:**

- Gold dust kits
- Story of the pirate searching a gold treasure
- Map of gold extraction sites
- A golden medal, a calculator, a coin, red pigment and a memory card
- Visual aids, photos and videos, showing the ornamental and decorative use of gold (for younger pupils)
- visual aids, photos and videos, showing some artisanal and small-scale mining (for older pupils)
- Gold ore
- Worksheet and teaching materials
- Didactic guides



#### **Specific questions addressed to the behaviour education**



At the end of the game, the teacher will propose reflect about how our daily activities can help to improve the lives of the people living in areas where mining is operating, and how can work together against climate change. The following ideas will intend the students review their daily behaviour regarding with, for example, recycling.

- Recycle your electric and electronic devices in the supply shops, NGO or in green points (younger)
- Check if they are recycling all appropriate elements at home in this specific container (older)
- Identification of the waste classification system implemented in the area (older)
- Check providers transparency in the supply chain (older)
- Check green points close to their homes (older)
- Preliminary identification of green or recycling points in the area (teacher)

### 3.3. THEMATIC BRIEFCASE: TIN and Daily Life

The Tin Thematic Briefcase highlights the prevalence of tin in our life: tin is found in various locations worldwide; is present everywhere to improve our quality of life; and has been used for a very long time. It links to several subject areas such as geography, science, history, design and technology and citizenship. The following learning objectives of the Tin Thematic Briefcase will be achieved through a variety of interactive activities:

- To find out where tin is found in different parts of the world (geography and science).
- To discover the main properties and capacities of tin (science) – preventing corrosion, combining with other materials and coating other metals.
- To identify the major applications of tin in both, historical and contemporary, contexts. From the Bronze Age to recent (science, design and technology, and history).
- To discover how tin is extracted and processed, including artisanal and small-scale mining (science).
- To discuss the impact of tin extraction and processing in the mining areas, including conflict minerals (geography and citizenship).
- To consider sustainable use of tin to reduce the negative impact, such as recycling, new technologies and our roles and responsibilities (science, design and technology, and citizenship).
- Thinking about the consequences of our purchase decisions for the people living in countries with mining activities
- Environmental impact of the non-recycling practices

#### Properties and applications of Tin

Tin applications in car manufacturing below<sup>3</sup> will be used for the main activity to learn the properties and capacities of tin as well as the wide applications of tin in contemporary world. It will demonstrate the usefulness and prevalence of tin in our daily life.

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<sup>3</sup> <https://www.internationaltin.org/how-is-tin-used/>



Figure 8: Tin in today's car

### Tin Briefcase Game

This range of applications in vehicles provides the opportunity to play a race, where the students will be the race drivers. They will start the race competition with a basic version of a car. The elements of the car can be upgraded answering questions regarding with the tin learning targets previously described. The right answers provide new car elements manufactured with tin, gaining points for the race.

Also, additional points can be gained improving other elements in the race, like communications or computers, and other daily life applications where other conflicts minerals<sup>4</sup> are involved (coltan, gold, wolfram...). The questions formulated provide the teacher the opportunity to discuss the impact of conflict minerals extraction and processing in the mining communities. The Conflict Minerals will show the linkage between the use of tin in our daily life and the impact in the mining communities in the world.

Also, Tin mining in Europe – Cornwall in the UK<sup>5</sup> - will also be shown and in case of older students, to consider why the mines were closed and if they should be re-opened will be discussed.

The student with more points at the end of the circuit wins the play.

<sup>4</sup> <https://www.globalwitness.org/en/campaigns/conflict-minerals/#more>

<sup>5</sup> <https://www.cornwall.gov.uk/environment-and-planning/conservation/world-heritage-site/>



Figure 9: Tin in our Smart phone

#### Tin Briefcase contents:

- Story of the race drivers
- Sets of Bingo Cards for students and Call Out Cards and for teachers
- Map of tin extraction sites
- Sets of Jigsaw Puzzles
- Jigsaw Puzzles Instruction for teachers
- A card model and a mobile miniature
- Visual aids, photos and videos, showing the tin applications (for younger pupils)
- visual aids, photos and videos, showing some artisanal and small-scale mining, and specific applications (for older pupils)
- Worksheet and teaching materials
- Cassiterite, stannite, coltan, scheelite, auriferous calcopyrite and carrolite
- Tooth paste, food can, pigments, a dye box, wine bottle overcap
- Didactic guides

#### Specific questions addressed to the behaviour education

At the end of the game, the teacher will propose reflect about how our daily activities can help to protect the environment, working together for a sustainable world.

- Drink and food cans recycling in the specific container at home (younger)
- Check if they are recycling all appropriate elements at home in this specific container (older)
- Identification of the waste classification system implemented in the area (teacher).

### 3.4. THEMATIC BRIEFCASE: RECYCLING AND PLATINUM

The Platinum briefcase toolkit aims to provide the essential knowledge to students related to the recycling processes of Platinum and other platinum group elements and their applications in everyday life.

Monolithos' products and the recycling and recovery processes which are implemented will help children to get a broader understanding on platinum group elements and especially platinum, and the importance of recycling.

#### **What is Platinum and which are its applications in everyday life?**

Platinum is an expensive and relatively rare precious metal. There are many fields in which platinum is present, like jewelries, ornaments and artifacts, in dental alloys and implants, in some surgical tools (defibrillators, cardiac pacemakers), in laboratory utensils, in hard disks, in special silicones for kitchen utensils, in electrical resistance wires, in aircraft and sport car industries, in making liquid glass displays in laptops, in LCD TV, in mobile phones and optical fibers. However, its most widely known use is as catalyst in catalytic converters, which are used in order to remove harmful pollutants from exhaust gases. A catalyst is a substance which increases the rate of a chemical reaction, without itself undergoing any chemical change. It is considered to be key player in clean energy technologies.

#### **How is Platinum extracted from the ore?**

An ore is a naturally formed mineral from which a pure metal can be extracted. For platinum there are the following minerals sperrylite, platinum arsenide and platinum sulfide. Platinum extraction from these ores is a long-lasting procedure which can take up to 6 months and up to 12 tons of ore to produce an industry troy ounce.

Platinum is located and mined all around the world, but more than 70 percent of the world's platinum supply comes from South Africa. Russia, Canada and Zimbabwe follow. There are two ways platinum amounts are produced, either from recycling of scrap and spent automotive catalysts or from mines.

#### **Platinum group elements contamination**

Platinum group elements contamination is noticed in airborne particulate matter (PM), roadside dust, soil, sludge, water and finally, the food chain. As a result, they accumulate in living organisms and tissues causing serious problems like asthma, nausea, increased hair loss, increased spontaneous abortion, dermatitis and others. Their metallic form is considered inert related to biological reactions.

#### **Monolithos' recycling and recovery processes**

Monolithos' products (catalytic converters, exhaust systems and particle filters) and its Research & Innovation department, contribute to the protection of public health and environment from vehicles emissions. Platinum group metals (Pt, Pd and Rh) are the state-of-the-art noble metals used as catalysts in catalytic converters for the control of the emissions from exhaust gases. End-of-life catalysts (spent auto catalysts) are recycled in order to recover the precious elements. Monolithos is not only recycling spent auto catalysts, but also make new catalysts, using recycled critical raw materials namely PGMs, rare earths and also cobalt, tungsten and vanadium by implementing cost-effective recycling processes.

### **Educational goals - learning by playing**

- Knowledge of wide range of objects containing platinum.
- Environmental impact of the non-recycling practices
- Understanding the importance of recycling spent auto catalysts and waste materials (used daily objects which contain PGMs) in order to mitigate the contamination caused by them.
- Platinum group mining in Europe and in the world
- Providing the students with the knowledge needed to understand mining processes.
- Motivate children from small ages to be sensitive about environmental protection.
- Older students will learn to estimate whether recycling conditions are met or not.

### **Platinum Briefcase Game**

The workshop of the Platinum Briefcase plays a race where the students will meet Platonas and Rodoula, two friends 8 years old (boy and girl), who will address the story of the competition. During the competition, the participants will deal with environmental restrictions that forbid their cars competing in the race. They will need to change some elements of the car and resolve other personnel questions that can affect the race (like a toothache) to run the circuit. They also need to protect some sensitive environmental areas against platinum residues by recycling. To resolve these situations, the students will answer questions regarding with the platinum group minerals applications, the recycling process or the environmental impact of the extraction processes.

The questions allow discussion and the professor will have the opportunity to address the issues (recycling, processing, environmental impact) in depth.

The students who complete the run circuit will check their points. The more, the winner.

### **Platinum briefcase contents**



- Platinum catalyst (the cordierite and catalyst powder)
- Platinum mineral and its mineral ore
- A jewelry (either a watch or a necklace/bracelet)
- A hard disk
- A mobile phone with LCD screen
- A denture with dental prostheses
- Cards with pictures of some applications and complimentary information
- Visual aids, photos and videos, showing the applications (for younger pupils)
- visual aids, photos and videos, showing some recycling process, and platinum minerals specific applications (for older pupils)
- Map of platinum minerals extraction sites
- Waste management plan for schools
- *Platonas and Rodoula's story*
- Worksheets and teaching materials
- Didactic guides



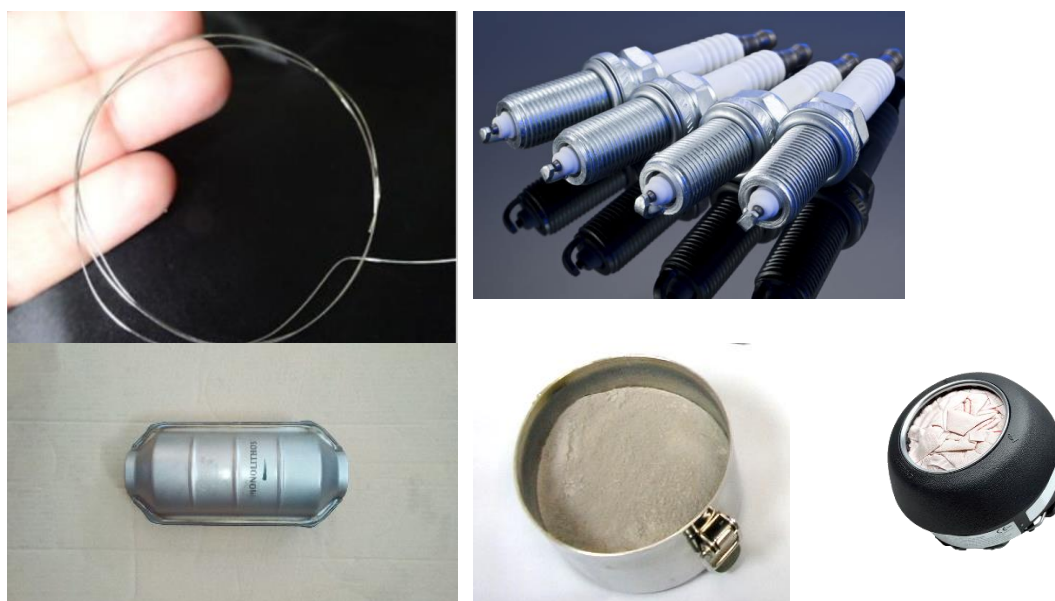


Figure 10: Some objects containing platinum included in the toolkit: right to left and up to down: platinum wire, spark plugs, catalyst powder containing Pt and other PGMs, and last: airbag safety system.

### Specific questions addressed to the behaviour education

At the end of the game, the teacher will propose reflect about how our daily activities that can help to protect the environment.

- Recycle your electric and electronic devices in the supply shops, NGO or in green points (younger)
- Check green points close to their homes (older)
- Preliminary identification of school initiatives for electronic waste collection systems (teacher)
- Potential implementation of electronic waste collection system in their schools (teacher)

### 3.5. THEMATIC BRIEFCASE: COBALT AND BATTERIES

The Cobalt Thematic Briefcase is focused on the diffusion of minerals knowledge among students, aiming to teach which minerals are used for the production of a mobile phone and to make the raw materials used in mobile phones more 'tangible'. The mobile phone is an ideal object for informing schoolchildren about our resource-intensive consumption habits, because 98 % of young people own their own mobile phones and thus have direct experience of this everyday accessory. The teachers who participate in our workshops are shown how to use the Briefcase in class. It's appropriate for teaching in a range of different subjects, from chemistry, geography and physics to social studies and ethics. Cobalt, which is used for the production of lithium-ion batteries, is discussed in particular.

#### **Hands-on learning about raw materials issues with the Briefcase**

Everyone knows them, and everyone uses them. From early childhood on, we all use more electronic devices than ever, especially mobile phones. All the more reason to teach kids as early as possible that electrical and electronic devices and the batteries they run on often contain hazardous substances – as well as valuable raw materials like Cobalt.

#### **Cobalt Briefcase Game**

What's inside electronic devices and batteries?

With the Briefcase, children aged 6 to 14 can explore this question in a playful and age-appropriate way. In our workshop with schools we want to encourage a critical, questioning attitude about how we use our devices (at a personal, societal, and global level) through hands-on learning and interactive educational games.

#### **Educational goals – Learn responsibility in a playful way**

- Which minerals are used in a mobile phone
- Raising awareness about the utility and indispensability of minerals and mining
- Learn about the consequences of their uses and production systems (social and ecological problems).
- Understanding that waste prevention is the first and most important step in the waste reduction hierarchy
- Raising awareness of the proper ways to dispose of waste electrical and electronic equipment
- Raising awareness of the importance of recycling
- Encouraging a critical, questioning attitude about how we use our devices (at a personal, societal, and global level)

- Making kids aware of how much energy is used to manufacture and recycle electrical and electronic equipment
- Learn more about the mineral Cobalt, its use and mining conditions
- Thinking about the consequences of our purchase decisions for the people living in countries with mining activities

### Briefcase contents

- Shredded materials of all different categories
- Disassembled mobile phone
- Primary raw materials ("Raw Materials Kit" from the Natural History Museum)
- Model Lithium-Ion battery
- Cobalt Ores (Skutterudite, Heterogenite, Erythrite)
- Variety of stripped cables
- Visual aids, photos and videos, showing the applications (younger)
- visual aids, photos and videos, showing some specific applications (older)
- Waste management plan for schools
- Map of cobalt extraction sites
- Environmental footprint calculator
- Worksheets and teaching materials
- Didactic guides








Figure 11: Raw Materials kit.

## good to know

Lithium batteries are found in a vast range of commonly-used devices. From mobile phones and immersion blenders to power drills and electric bikes, they're impressively powerful – but should be handled with care.



**Did you know that** lithium batteries are up to 75% recyclable? They also contain valuable raw materials like cobalt and nickel that can be recovered through modern recycling processes.

---

**Did you know that** an electric car contains up to 7000 lithium cells?

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**Did you know that** the world's first electric car was presented at the 1900 World Fair in Paris by Ferdinand Porsche?

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**Did you know that** lithium has been successfully used in medications for depression, schizophrenia and Alzheimer's disease?

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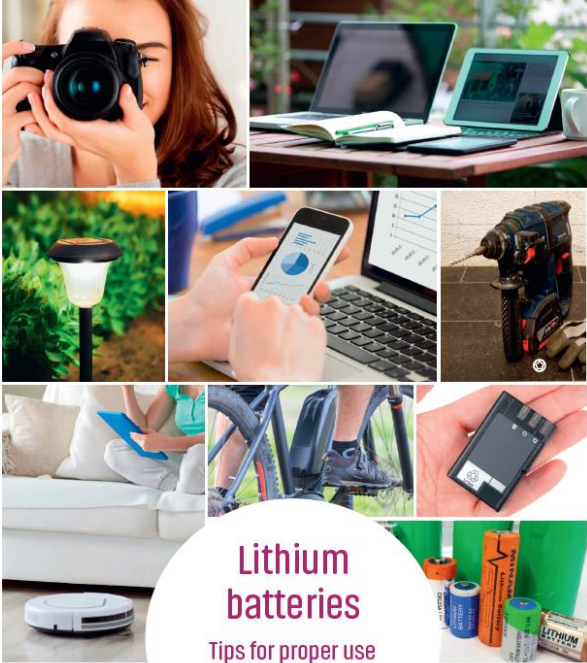
**Did you know that** nearly all of the world's currently accessible lithium reserves are found in South America, China and Australia?

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**Did you know that** there is more lithium in the Earth's crust than cobalt, tin or lead?

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DISCLAIMER Lithium batteries come in a variety of designs and chemical compositions. Therefore, this brochure only presents tips on working with lithium batteries in general. Although the contents of this brochure have been carefully researched and prepared in cooperation



## Lithium batteries

Tips for proper use

Handle with care  
Avoid damage




Figure 12: Example of Worksheet – Lithium Battery.



Figure 13: Cobalt ore minerals, to be included in the workshop, Left to right: skutterudite, erythrite, heterogenite.

### Specific questions addressed to the behaviour education

At the end of the game, the teacher will propose reflect about how our daily activities that can help to protect the environment.

- Recycle your electric and electronic devices in the supply shops, NGO or in green points (younger)
- Check green points close to their homes (older)
- Check providers transparency in the supply chain (older)
- Preliminary identification of school initiatives for electronic waste collection systems (teacher)
- Potential implementation of electronic waste collection system in their schools (teacher)



### 3.6. THEMATIC BRIEFCASE: SECONDARY RAW MATERIALS

The Secondary Raw Materials Thematic Briefcase is focused on the diffusion of the importance of recycling among students, aiming to teach the different applications of the recycled materials manufactured with the most common residues. The teachers who participate in our workshops are shown how to use the Briefcase in class. Due to the specific products and applications explained during the workshop, it is appropriate for teaching pupils in secondary school (not for the youngsters).

#### Hands-on learning about recycling with the Briefcase

The pupils can see and touch the products manufactured with recycled materials, checking that in the most part of the cases, there is no way to know if the new products are eventually manufactured with primary or secondary raw materials.

#### Secondary Raw Materials Briefcase Game

What residues can be recycled?

With the Briefcase, children aged 10 to 14 can explore this question in a playful and age-appropriate way. In our workshop with schools we want to encourage a critical, questioning attitude about why we should recycle through hands-on learning and interactive educational questions.

#### Educational goals – Learn responsibility in a playful way

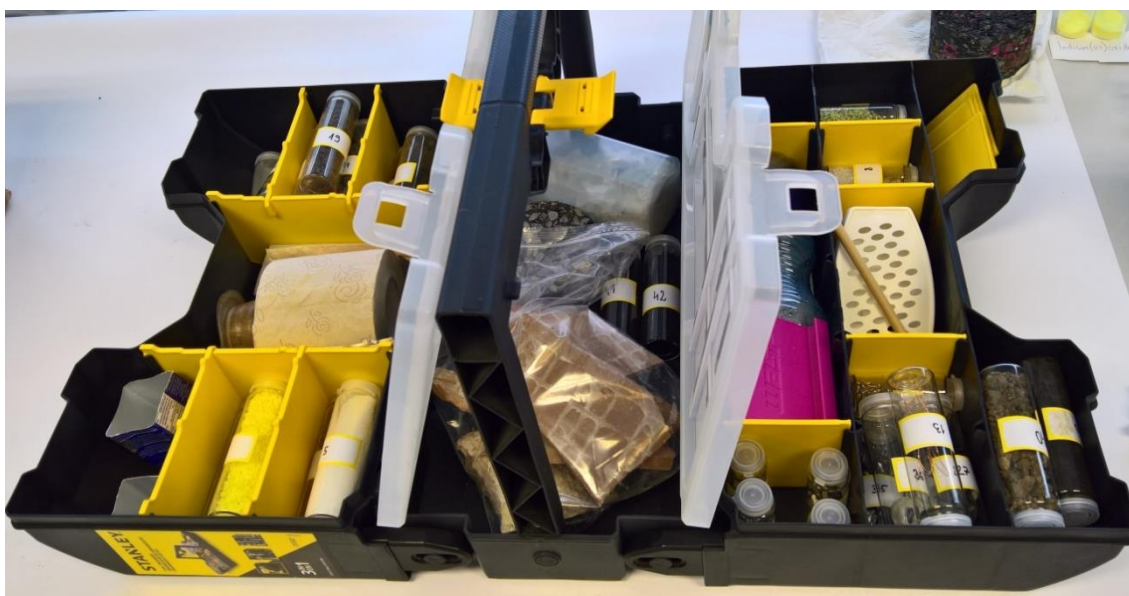
- Which residues can be recycled?
- Raising awareness about the utility and indispensability of minerals and mining
- Understand why some raw materials are considered critical in the UE.
- Learn about the social consequences of the mineral exploitation in non-sustainable mines.
- Understanding that waste prevention is the first and most important step in the waste reduction hierarchy.
- Raising awareness of the proper ways to dispose the daily produced residues around us.
- Raising awareness of the importance of recycling.

#### Briefcase contents

- Residues: tetrapack, orange peel, plastic bottle and cup, copper wire, rubber waste, construction and demolition wastes, wastes from thermal processes from power and incineration plants, iron, steel and glass industry, extractive mining like ash, mining tailings, slags and sludges, and wastes generated by municipal

services like inert heavy fraction from municipal solid waste, sewage sludge from municipal waste water treatment and plastic fraction from municipal waste.

- By-products from the residue's treatment like cardboard, paper, aluminium foil, plastic, plastics granulates, recycled copper, brass shavings, brass, tinned bronze
- Products manufactured with (recycled) wastes: wipes and tiled paper, pen cases, examples of 3D printing (a cup and plastic figures), trash can, green concrete, geotechnical composites, recycled aggregates, asphalt, bio charcoal, compost, soil.
- Photos of tailings facilities, wastes, by products and products manufactured with recycled materials to illustrate the applications and the recycling process
- Didactic guides



### Specific questions addressed to the behaviour education

At the beginning of the workshop, a couple of short videos are projected. First one is about the importance of the raw materials, showing how would be our world without them. Second one is a short documental in which a boy who lives in RD Congo explains

in first person how was his life when he worked in a non-sustainable mine. The boy is around 9 years old, which generates empathy and the story really impacts on the pupils (and teachers) attending the workshop.

During the workshop, the teacher proposes to reflect about the daily used materials which can be recycled, not only to protect the environment, but also to reduce the primary raw materials consumption. Specific questions regarding the appropriate place to recycle the residues or the potential recycling alternatives from them are addressed to the pupils.

- Which residues can be recycled?
- Where these residues should be deposit to be recycled?
- What treatment process can be applied for recycling these residues?
- Why should we recycle the residues?



### 3.7. THEMATIC BRIEFCASE: NEW VERSION OF THE DAILY USES OF MINERALS

The new versions of the Daily Uses of the Minerals Thematic Briefcase are focused on the importance of the minerals in our lives, like in the original version.

The preliminary idea was to copy the original one to be used in Basque Country and Slovenia, translating it to Slovenian. But (learning by doing) the team decided to improve the original one in the last versions, extending the content and increasing the minerals in the briefcase.

#### Daily Minerals Briefcase Game

The game in the updated version of the Briefcase takes the same structure than in the original version but, in our experience with the original briefcase, sometimes the clues were really difficult, so the in the Slovenian version, the new cards have been improved with new east clues. The tool is dedicated to children aged 10 to 14 as in the original version.

#### Educational goals

Education goals of the new versions are the same than in the original one.

#### Slovenian Briefcase contents

The Slovenian Physical Briefcase consists of 20 minerals and 28 objects but new minerals have been selected to be included and it has been updated with new minerals and objects a couple of times from them and it is planned to be updated regularly to ensure its liveability and increase the demand of teachers and other interest groups of using it on regular basis.

At the time of this report, the content is the following:

- Minerals: cinnabar, kyanite, sphalerite, fluorite, galena, lepidolite, magnetite, malachite, orthoclase, wolframite, gypsum, kaolinite, graphite, hematite, bauxite, chromite, quartz, spodumene, rutile, muscovite, talc, bornite, halite.
- Applications: thermometer, frugal lead bulb, soda can, wire covered with zinc, tooth paste, lead battery, Pb-metal (soft), lead bullets, fishing weight, Li-ion battery, horse shoe, bronze wire, coin, bronze plate, bronze plumbing pipe, cup, light bulb, gypsum plaster, paper, rubber, pencil, pigments, make up power, deo can, CD, green glass bottle, sand watch, ceramic cup, kitchen salt
- A sand clock.
- Cards with clues.

- Scoreboard template.
- Didactic guide.

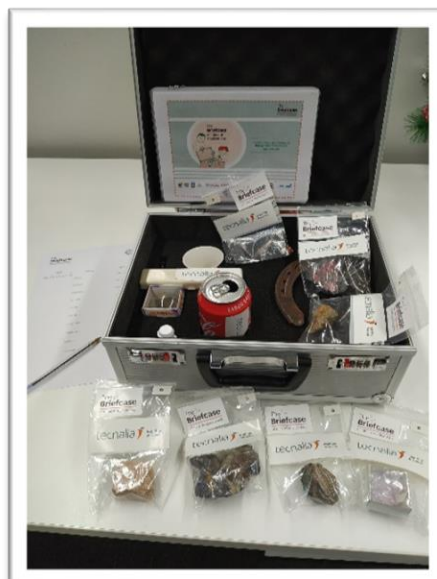


### Basque Country Briefcase content

The Basque Physical Briefcase consists of 10 minerals and 10 objects from the original daily Briefcase, but it has been updated with new different minerals of Fe because of the historical iron mining past in the Basque country.

At the time of this report, the content is the following:

- Minerals: cinnabar, kyanite, sphalerite, fluorite, galena, lepidolite, magnetite, malachite, orthoclase, wolframite, hematite, siderite, ankerite and Goethite
- Applications: thermometer, lead bulb, soda can, galvanized steel, tooth paste, Li-ion battery, horse shoe, wire, light bulb, ceramic cup,
- A sand clock.
- Cards with clues.
- Two new games. sink the ore (based on the sink the float game) and look for the element.
- Scoreboard template.
- Didactic guide.



### Updated version of the original Briefcase content

- Fe minerals: hematite, siderite, ankerite and Goethite (and magnetite above mentioned)
- Two new games. sink the ore (based on the sink the float game) and look for the element.

### Specific questions addressed to the behaviour education

The questions addressed to the children are the same than in the original version, but the workshops have been improved with the projection of a couple of films to introduce the pupils to the minerals world and to reflect about the consequences of the mineral exploitation in countries where the human rights are not preserved.



### 3.8. THEMATIC BRIEFCASE: THE PHONE MINERALS

The Phone Minerals Thematic Briefcase is focused on the different minerals used to manufacture our phones. The tool is appropriate for pupils from early age up to 14 years old, depend on the module and the activity. The briefcase aims to provide the students basic knowledge about the elements/raw materials that are contain in a mobile phone, the importance of the use of resources and address terms such as resource scarcity and sustainability, but also highlight the importance of the appropriate disposal and recycling of mobile phones to recover all the valuable metals that are contain on it.

The teachers who participate in our workshops are shown how to use the Briefcase in class and give them didactic material to use also.

The is briefcase is based on the called “Elektroaltgeräte- und Altbatterien- Schulkoffer” (WEEE and Waste Batteries School-Kit). The briefcase had been bought to the Elektroaltgeräte Koordinierungsstelle Austria GmbH (Austrian Coordination Body For Waste Electrical And Electronic Equipment) and translate to Spanish to be able to use it in the schools.

#### The Phone Minerals Briefcase Game

With the Briefcase, children aged 5 to 14 can explore the raw materials that we want find in a mobile phone in a playful way using a magnetic magnifier and try to answer some questions It is also highlighted the materials that are able to obtain from the waste and the importance of secondary resources for the sustainability.

The students have to examine the raw materials in the material case that we can find in a mobile phone.

Metal	%	In the briefcase	Number	Aplication
<i>Cupper</i>	<i>15%</i>	<i>Chalcopyrite</i>	<i>Nº 1</i>	<i>Printed circuit board, various cables and compounds</i>
<i>Silizium</i>	<i>8-15%</i>	<i>polysilicon</i>	<i>Nº 2</i>	<i>Microchip</i>
<i>Iron</i>	<i>3-8%</i>	<i>Magnetite</i>	<i>Nº3</i>	<i>Screws, springs</i>
<i>Aluminum</i>	<i>4-9%</i>	<i>Bauxite</i>	<i>Nº 4</i>	<i>Battery casing</i>
<i>Lithium</i>	<i>3-4%</i>	<i>Lepidolite</i>	<i>Nº 5</i>	<i>Battery</i>

<i>Plastic</i>	<i>40-60%</i>	<i>Bituminous Silicon Rock.</i>	<i>Nº6</i>	<i>Case, keyboard, Some parts of the printed circuit board</i>
<i>Ceramic</i>	<i>3-10%</i>	<i>clay</i>	<i>Nº 7</i>	<i>Insulators and capacitors.</i>
<i>Gold</i>	<i>&lt; 1%</i>	<i>gold</i>	<i>Nº 8</i>	<i>Contacts, thin wires.</i>
<i>Silizium</i>		<i>quartz</i>	<i>Nº9</i>	
<i>Tantalum</i>	<i>&lt; 1%</i>	<i>Coltan</i>	<i>Nº 10</i>	<i>Condensers</i>
<i>Silizium</i>		<i>Silizium granulat</i>	<i>Nº11</i>	<i>Microchips</i>

They have to use the magnetic magnifier and try to answer the next questions.

1. What colour is the raw material? How would you describe the raw material?
2. How is density estimated: the raw material is relatively light or heavy?
3. What do you think you get a metal or a non-metal from the raw material?
4. How do you think the raw material grates? Like a nail (harder than 2-3), a knife (hardness  $\geq 5$ ) or even scrape the glass (hardness  $\geq 7$ )?
- 5 What minerals can it be or what raw material is extracted from it? Do you know the name?
- 6 What components of the mobile phone could be manufactured from that mineral? Place the corresponding component of the mobile phone next to the raw material.

### **Educational goals – Learn responsibility in a playful way**

- Raising awareness about the utility and indispensability of minerals and mining
- What elements/raw materials are in the mobile phone.
- Understanding that waste prevention is the first and most important step in the waste reduction hierarchy
- Raising awareness of the importance of recycling to obtain valuable materials

### **Briefcase contents**

- Disassembled mobile phone and several components
- Metal sheets
- Material recycled
- Visual aids, photos and videos, showing the applications (younger)

- Raw materials kit that contains:
  - o Chalcopyrite -> copper
  - o Post Crystalline Silicon
  - o Magnetite -> iron
  - o Bauxite -> Aluminium
  - o Lepidolite -> Lithium
  - o Oil shale -> petroleum
  - o Clay mineral montmorillonite
  - o Gold
  - o Quartz -> Silicon
  - o Tantalum ore -> tantalum
  - o Post crystalline silicon granulate
- Magnetic magnifier
- Didactic guides with worksheets and teaching materials





### Specific questions addressed to the behaviour education

At the end of the game, the teacher will have a reflexion at class about how our daily activities can help to protect the environment.

It will also highlight the importance of the appropriate discharged of the old devices and how we can help to reobtain valuable materials.

#### 4.- SUMMARY AND FOLLOWING STEPS: TOWARDS THE VIRTUAL BRIEFCASE

This new minerals and objects analysed in the thematic briefcases have been incorporated to the IGME briefcase and they are the basis of the “virtual briefcase” that contains the former IGME minerals and the new ones. The virtual game can be found through the following link.

<https://www.thebriefcasegame.eu/>

The following image shows some ore minerals from this new element- thematic briefcases.



Figure 14: New minerals to be included in the IGME web toolkit. Images: up to bottom: erythrite (cobalt ore) from Almeria Spain. Skutterudite (cobalt ore), from Bou Azzer mines Morocco. Bottom left: cassiterite (tin ore) Bolivia. Gold, from gold panning workshop, Segre River Catalonia, Spain.



## 5. TRANSVERSAL GOLDPANING WORKSHOP

Surprisingly several of the elements analysed in the state of art and chosen for the briefcases are found in alluvial deposits. Gold, tungsten, tin and platinum are historically mined with dragging and panning.

Everybody knows the gold rush and the gold panning system in movies. This technique is still used to find heavy minerals and gemstones in small scale mining and also by geologists and prospectors.



Figure 15: Real gold panning finding gold and cassiterite in a stream-river in Salamanca province (Spain).

The gold panning is a friendly way to approach mining to kids. They are fascinated by the “far west” gold rush. Although is not a precise approach to the 21<sup>st</sup> century mining is a very easy way of engagement.

Many toolkits and toys dealing with gold nugget prospecting can be found in the market such as Playmobil, mainly addressed to the children.

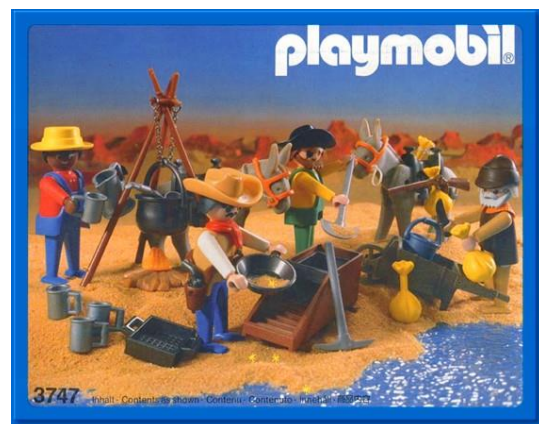
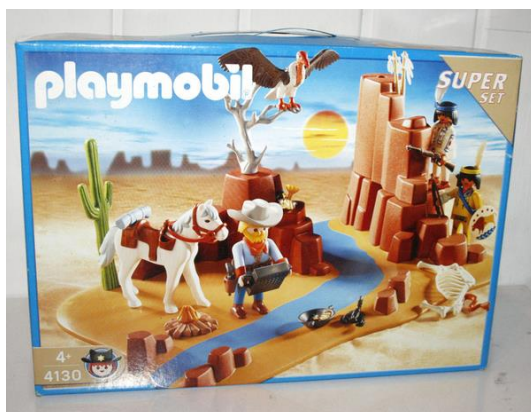






Figure 16: Golpanning toys and toolkits.

IGME usually applies this technique for researching purposes and also to teach to kids. The train can be performed in rivers and streams but also in workshops using small containers with water (see images below).

How is the workshop like? A real goldpanning workshop (without the river) is replicated.

- The workshop leader, who can be a teacher, put sand in a small bag mixed with a metallic concentrate (dark) containing iron ores, casiterite or galena, then we also add 3 or 4 pyrite pieces (small) to simulate gold nuggets.
- The gold extraction process with the pans is detailed by the workshop leader, who perform a demonstration to train the students.
- Students try to separate the sand from the heavy minerals using the pans. The sand ends in the container while nuggets remain in the pan.

Now, the Briefcase Project proposes to update the workshop including an introduction by the workshop leader to initiate the students to the alluvial deposits, the mineral erosion, transport and sedimentation. In case of older students, this provide the teacher the opportunity to deep into the social impact of mining, for example, the massive migration to California around 1850 or, more recently, the conflict among the government, illegal miners, private sector companies and armed groups in Colombia. Understanding the global importance of mining together with the “funny” goldpaning practice will encourage them to follow the mining career.

Requirements to replicate the workshop:

- Pans
- Concentrate and nuggets
- A container with water and sand



Figure 17: The Gold Museum in Catalonia sells a small bag with sand and tinny gold nuggets. You can “pan” them in a “indoor” panning place.



Figure 18: Indoor panning in Catalonia Gold Museum.





Figure 19: Outdoor gold panning workshop, with sand and pyrite instead of gold in a small concrete container (Almaden Spain).



Figure 20: Young separating pyrite nuggets from the gravel and sand in the pan.