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THE ITER PROJECT: HOW DAVID COOPERATES WITH GOLIATH

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Caterina Rehm-Berbenni
Good afternoon honoured guest, good afternoon gentlemen and ladies. I would like to present the results of the ITER project, which has come to an end, last July and has some very interesting results to show.

[Slide2] I would like to begin showing a masterpiece of wooden marquetry of 1540. Lorenzo Lotto's choir, which can be admired in the Basilica of Santa Maria Maggiore in Bergamo, Italy. One of the panels shows the whole story of David and Goliath in one wooden piece of 1,30 x 0,80 meter. I choose one particular of this story, because I also saw as a similitude representing how research and industry often work, or not work together. This phenomenon is due to the fact that SMEs, here represented by David, often had and still have fear of losing their ideas and potential for innovation. On the contrary, the big institutes, here represented by Goliath, sometimes live in a ‚turris eburnea' an ivory tower, remote from the practical life.

[Slide 3] When we began to discuss the ITER idea, this was a world wide innovation and a fundamental research project. At that time we had a lot of discussions concerned with the fear of some SMEs to hand over the idea to the institutes and then loose the innovation itself. However, we recognised from the very beginning the essential need to gather a strong interdisciplinary team, working together to reach the common goal. We considered the EU CRAFT programme as being the best opportunity to support such cooperation. We had four SME proposers, the company Hydroisotop from Germany specialised in light isotopes; the company Servin from Italy specialised in environmental services; the company Krusemark from Germany as a mortar producer and FUTUREtec from Germany specialized in Information Technologies, technology transfer and intellectual property rights. The research institutes IFE, Institute for Energy Technology from Norway specialized in heavy isotopes and CNR, Centro Nazionale delle Ricerche Gino Bozza from Italy, specialized in mineralogical analysis.

[Slide 4] We deemed to be of vital importance for the success of this project to involve also three sub-contractor stakeholders. Three Roman sites from the same historical period have been selected: the Soprintendenza Archeologica del Lazio, Italy (Villa Traiana near Rome); the Israel Antiquities Authorities, Israel (Caesarea Marittima); and the Landesverband Rheinland, Germany (Archaeological Park Xanten). ITER has demonstrated that one of the keys to success in this project has not only been the cooperation among research and industry, but also the involvement of the three antiquities authorities' stakeholders and one business SME, also during the phase of fundamental research.

[Slide 5] Let me explain quickly, the ITER objectives and the results. The objectives have been to demonstrate the scientific validity of isotopic analytical investigation. To create an innovative database of mortar characteristics based on the collection of all

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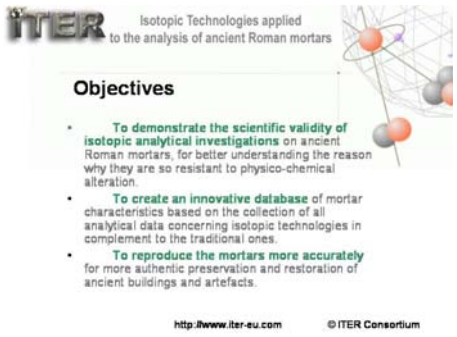

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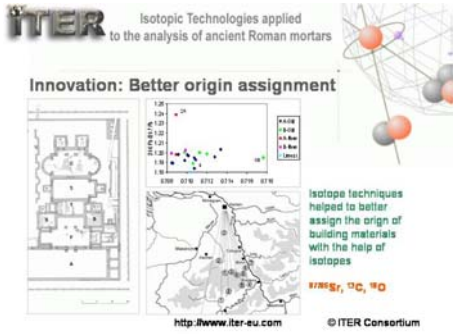

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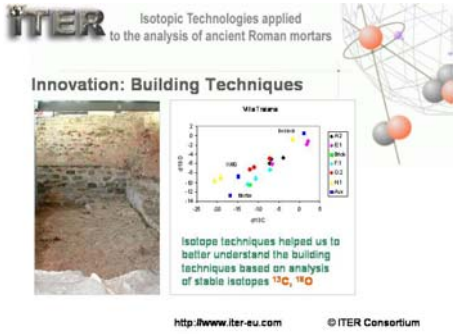

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analytical data concerning isotopic technology in complement with the traditional one. In this database we have also collected all the information that we could gather concerning also the three case study sites that we have analysed.

[Slide 6] The first innovation we have reached with ITER is a better origin assignment. The strontium, carbon 13 and oxygen isotopes analysis have allowed us to better assign the origin of building materials.

[Slide 7] Another innovation deals with building techniques and here the isotopes analysis, especially the carbon 13 and the oxygen, helped us to better understand the building techniques and in particular to understand the differences.

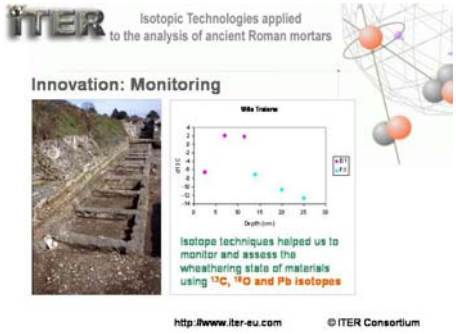
[Slide 8] The third innovation deals with monitoring. Isotope techniques helped us to monitor and assess the weathering states of materials using the carbon 13, the oxygen and also, in this case, the lead.

[Slide 9] One of the major outcomes is the internet ITER database which contains the key mineralogical and isotope data of this study site.

[Slide 10] Today I have brought with me some samples of ancient Roman mortars and the company Krusemark has also provided the prototypes at laboratory level of the new mortar, which I can show later to all those who are interested.
But the heart of the innovation of the ITER project lies in the fact that the morphological study of old mortars and the carbon 13 analysis have provided important data, substantiating the hypothesis that lime mortars have a reaction potential. Crystallisation of Roman mortars might not be limited to a defined time span closed to the time of construction of the building; crystallisation might take place during hundreds, in some cases thousands, of years. This is only possible if part of the lime used is inactive at the moment the building is constructed and during the initial hardening process. The morphological analysis has shown that the storage of reactive lime and mortar might be provided by an encapsulation of lime nodules. While the outer surface is calcified sealing the inner part, the core of the nodule still contains calcium hydroxide that can react upon physical stress, cracking on associated contact with CO2. The encapsulation of part of the binder in nodules therefore is an important part of the preparation technique. In fact, due to encapsulation, the amount of active or reactive binder at the moment of construction should be close to the binder. Aggregate ratios are being used in modern mortars. The rest of the binder can be encapsulated representing a storage. This property can explain the durability of Roman mortars: upon access of CO2 to cracks, the capsules react and due to this process, areas under structural stress are fortified by calcite veins along the line of cracks. This behaviour represents a healing capacity. This is what the ITER consortium likes to call, “living mortars”.

[Slide 11] According to the directive of the EU CRAFT Cooperative Research, the benefit for the SMEs lies in the fact that the results of the project are available for the ITER SMEs as the joint owners of the results: new methods for assessing weathering states, environmental impact, material authenticity and provenance; an internet database, and a mortar prototype at laboratory level.
We have produced also a supplementary and non required result consisting in a cooperative working tool to ease the management of interdisciplinary teams.

[Slide 12] There are several target sectors for the dissemination



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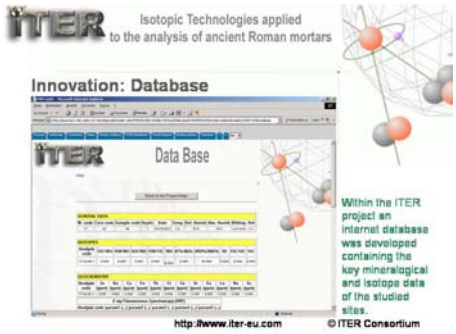

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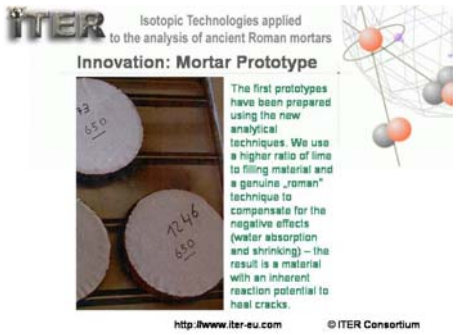

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and exploitation of the ITER results. For example in the fields of analysis of building materials as well as monitoring and condition assessment; secondly, the conservation of historical buildings; thirdly, the production of new raw materials for construction, which are more resistant than what we have produced during the last 50 years. The case of the University of Bochum in Germany might be an example already known to you; a cement construction built 40-45 years ago, which now need to be destroyed and rebuilt because decayed and no longer secure for people.

[Slide 13] The ITER project is expected to have a spin-off, not only on historic building conservation, but also urban environment monitoring, material monitoring and new building techniques. The results can help to improve and control the quality of conservation measures. The state of buildings, especially environmental impacts due to traffic and air pollution can be better distinguished from deterioration related to the reconstruction and materials used. In the future the methodologies could help to monitor the state of cultural heritage on a European level and provide dedicated tools for discussion and deliberation to decision makers.

[Slide 14] Let me go back to our picture of David and Goliath. Why did this project become a success? The reasons are simple: David (the SMEs) overcame the fear of losing their innovative ideas thanks to the protection of intellectual property. Goliath (the research institutes) brought in and shared their specific and fundamental knowledge. The stakeholders did an excellent job providing their precious day-to-day practical experience. The successful cooperation was secured through a solid teamwork, building trust and consolidating it during the project's life time, as well as sharing interdisciplinary expertise and knowledge among partners and stakeholders.
At this point there are two persons whom I would like to express our deep gratitude: our scientific officer Mr.Brian Brown, who is among us today, for the help and support he provided during the project; and the former Head of Unit Mr. David Miles, who encouraged and supported us in difficult moments.
In a world given over to globalisation, local heritage and culture gives a much needed security to people's sense of identity and their community's ability to recognise themselves, so we need to build up on cultural heritage for the future.

[Slide 15] My name is Caterina Rehm-Berbenni, I am one of the Chief Executive Officers of FUTUREtec and I thank you for listening.

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