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Teaching resources in speleology and karst: a valuable educational tool

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Abstract:

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There is a growing need in the speleological community of tools that make teaching of speleology and karst much easier. Despite the existence of a wide range of major academic textbooks, often the caver community has a difficult access to such material. Therefore, to fill this gap, the Italian Speleological Society, under the umbrella of the Union Internationale de Spéléologie, has prepared a set of lectures, in a presentation format, on several topics including geology, physics, chemistry, hydrogeology, mineralogy, palaeontology, biology, microbiology, history, archaeology, artificial caves, documentation, etc. These lectures constitute the "Teaching Resources in Speleology and Karst", available online. This educational tool, thanks to its easily manageable format, can constantly be updated and enriched with new contents and topics.

Keywords: *Karst, Speleology, Teaching, Education, Lectures*

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INTRODUCTION

Karst studies and speleology are increasingly important in the scientific community finding applications in fields such as hydrogeology (Goldscheider & Drew, 2007), natural and anthropogenic hazards (Parise *et al.*, 2008, 2009; Parise & Gunn, 2007), geomorphology (De Waele *et al.*, 2009), mineralogy (Hill & Forti, 1997), biology (Culver & Pipan, 2009), microbiology (Barton, 2006; Cuezva *et al.*, 2009), palaeoclimatology (Genty, 2008) and many others topics. However, these scientific resources are often not easily accessible to non-scientists and cannot be directly used for education purposes. Also the many textbooks on speleogenesis (Gabrovsek *et al.*, 2005; Klimchouk *et al.*, 2000; Klimchouk, 2007), karst geomorphology and hydrology (Ford & Williams, 2007; White, 1988) or the two major encyclopaedia on the subject (Culver & White, 2004; Gunn, 2004) are not suitable for teaching speleology and karst to non-scientists. Only the recent book by Art Palmer is definitely a step forward towards science education suitable to a wider public (Palmer, 2007).

Education is an extremely important issue in karst protection (Zokaites, 2003). Early efforts in finding a way of teaching karst to non-scientists go back to the late 70's and 80's (Kent & Ross, 1975; Palmer, 1984). Especially karst-related hazards are suitable topics

that that can be profitably used to teach the peculiarity of the karst environment to local communities (Buskirk *et al.*, 1999). There are many examples of booklets that explain the fragile karst environment to the students, citizens and agency personnel (Veni *et al.*, 2001; Zokaites, 1997, 2007).

Teaching karst science to cavers is important because of the extraordinary work they carry out as an essential part of scientific studies carried out in caves and karst areas. An example is given by tracer tests, in which dyes are injected in cave streams deep inside the mountains and later detected, often in an automatic way, at the karst springs (Goldscheider *et al.*, 2008). Also many palaeoclimate studies often use samples of speleothems taken deep inside sometimes complex cave systems (Zanchetta *et al.*, 2006), or new species of animals sampled in remote areas of caves are described (Culver & Pipan, 2009). It is obvious that without the help of expert cavers these samples would not be available to many scientists.

To allow cavers to become an active part in the scientific researches carried out in karst areas and caves they have to train themselves and become familiar with science. In this way they will not only perform simple tasks such as drilling speleothems or catching cave beetles, but can become responsible of choosing the right sites, collecting samples in the correct way, or record all types of chemical and physical data from sometimes complex monitoring devices.

In order to bring some of this science closer to the speleological community a three year project has been

launched at the end of 2006 by the Italian Speleological Society (SSI) (De Waele, 2007) and carried out under the umbrella of the Union International de Spéléologie (UIS) and is here described.

METHODS

Lectures on over 50 topics have been prepared as computer presentations. Each lecture is composed of a number of slides, ranging between 19 and 147, starting with a title slide (Fig. 1) and ending with two slides containing bibliographical references and credits respectively (Fig. 2).

All cited references are available in the SSI library at Bologna and normally are review articles or important text books. Lectures are composed by experts in their fields, whom often have involved several collaborators among colleague scientists, photographers and designers. More than 100 covers have in some way contributed to the scientific contents of the slides, while photographs have been provided by more than 300 persons. Because most of the experts and collaborators are Italian, also many examples are related to this country. Nevertheless general contents are valid globally, and if the user wants to change examples and pictures in the lecture this can be easily achieved, rendering the lectures more country specific.

The main characteristics of the project are outlined in Table 1.

Slides have a black background and a footnote reporting the lecture and the symbol of the SSI. Font is Verdana, 20 for main text, 32 for titles and 10 for photo and figure captions. Font colour is always white or yellow. The font type and colour and the background have been decided to allow a comfortable view also to people with sight problems (e.g. people with daltonism) (Dini *et al.*, 2007) (Fig. 3).

All slides and lectures have been peer reviewed and typeset by a pool of correctors-designers before final submission. Final Italian versions have then been translated by mother tongues in English, French and Spanish.

Table 1. Main characteristics of the Project

Lectures	58
Slides	>3600
Slides/lecture	~ 62 (19-147)
Authors	120
Photographers	330
Designers	57
Correctors	10
Typesetters	9
Final layout	4
Translators English	8
Correctors English	5
Translators French	20
Translators Spanish	4

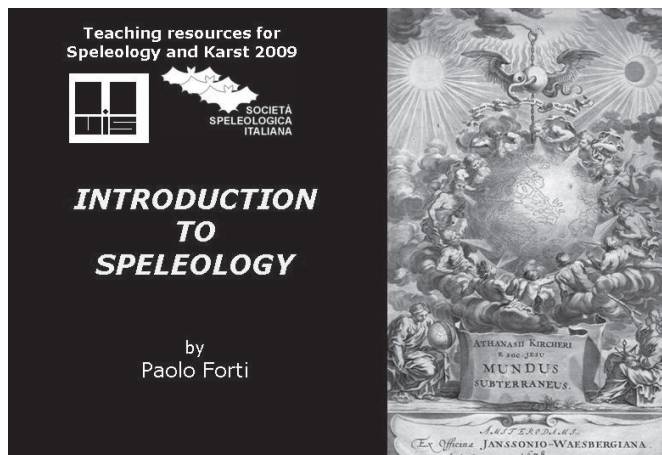


Fig. 1 – First slide of the Introduction lecture.

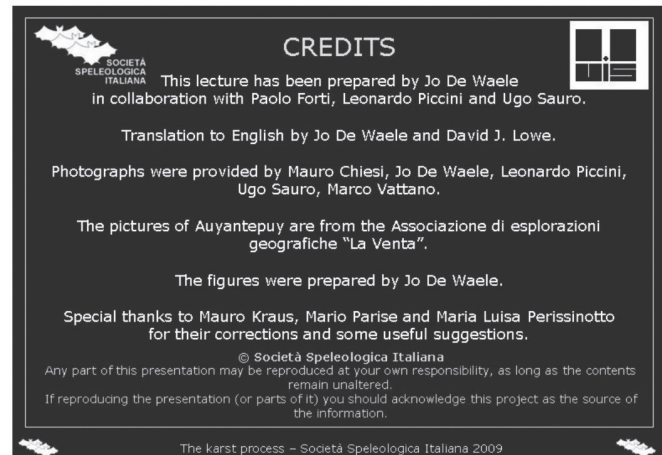


Fig. 2 – References and credits slides (respectively last but one and last slide of each lecture)

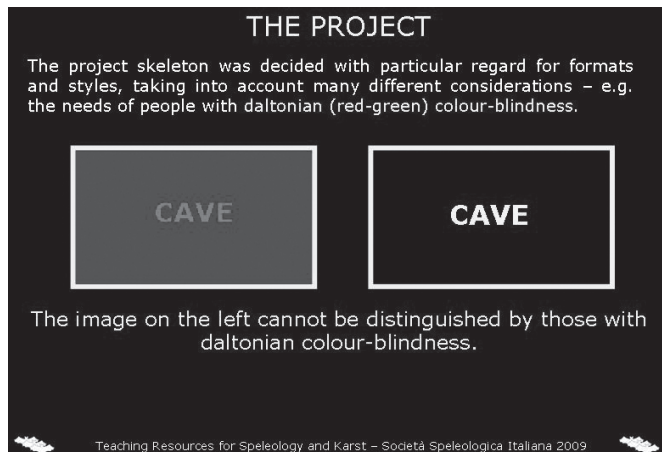


Fig. 3 – Slide showing the layout followed for colour-blind people

Table 2 – Lectures for the moment included in the Project

N°	Title	Coordinator	Collaborators	N° of slides
1	Introduction to Speleology	Forti		64
2	Evolution of Speleology in Italy	Sello	Guidi, Muscio	69
3	Speleology and Scientific Research	Forti		45
4	The Karst Process	De Waele	Forti, Piccini, Sauro	45
5	Dolines and large karst forms	Sauro	Madonia G.	64
6	Karren: landforms sculpted in rock	Sauro		56
7	Karst landscapes and Geo-ecosystems	Sauro	Castiglioni	62
8	Italian karst phenomena	Sivelli	Benedetti, Chiesi, De Waele, Fallani Forti, Galdenzi, Gioia, Ischia, Larocca, Mancini, Mecchia, Mecchia, Menichetti, Micheli, Parise, Roncioni, Panichi, Salvatori, Santo, Santangelo, Sauro, Sivelli, Tognini, Vattano, Vigna	147
9	Speleogenesis in carbonate rocks	De Waele	Forti, Piccini	55
10	Structure and Morphology of Karst Systems	Piccini	Balbiano, De Waele	59
11	Chemical deposits in caves	Forti		56
12	Speleothems 1	Forti		59
13	Speleothems 2	Forti		48
14	Speleothems and scientific research	Forti		60
15	Climatic archives in caves	Verheyden	Railsback, Shopov, van Breukelen, Delaby, Urgan, Genty e Nader	37
16	Sampling or not?	Forti		55
17	Hypogenic caves	De Waele/Forti	Audra, Galdenzi, Menichetti, Piccini	100
18	Marine caves	Antonoli	Forti	61
19	Caves in Flysch	Tavagnutti	Comar	37
20	Karst phenomena in evaporites	Madonia G., Forti	Chiesi, Messina, Rossi, Sauro, Vattano	72
21	Caves in gypsum	Madonia G., Forti	Chiesi, Messina, Rossi, Sauro, Vattano	64
22	Speleogenesis in quartz and silicate rocks	Piccini	De Waele, Forti	39
23	Volcanic caves	Giuffrida Pr.	Cerquetti, Conti, De Waele, Forti, Giudice, Madonia P.	65
24	Karst in Glaciers	Badino		56
25	Cave-mines and Mine caves	Forti	De Waele	45
26	Caving techniques 1	Badino		36
27	Caves: basic climbing techniques with SRT	Badino		47
28	Cave Diving	Fileccia	Eugenio Bottacini, Leo Fancello, Mario Mazzoli, Gilberto Bonaga, Gérald Favre, Dario Genova e Mario Marconi	60
29	Prevention of accidents in caves	Vattano	Giovanni Badino, Paola Bianchi, Corrado Camerini, Jo De Waele, Francesco Di Trapani, Paolo Forti, Franco Gherlizza, Mauro Kraus, and the Public Relations Working Group of the Cave and Alpine Rescue Team	36
30	First aid in caves	Buccelli	Commissione Medica Speleo del CNSAS	19
31	Cave Surveying	Villani		60
32	History of Biospeleology	Rivalta, Serena	Bani, Bianco, Casale, Inguscio, Lana, Lanza, Latella, Rampini, Sbordoni	53
33	Sampling and documenting subterranean life	Inguscio, Bani	Rivalta, Serena	72
34	Systematics and adaptations of cave fauna	Serena, Latella	Agnelli, Messina, Rampini, Rivalta	61
35	The cave ecosystem and its conservation	Serena, Bianco	Agnelli, Bianucci, Latella, Messina, Rivalta, Vanni	57
36	Troglophile bats	Mucedda	Agnelli, Martinoli	55
37	Temperature in caves	Badino		68
38	Aquifers in carbonate rocks	Vigna	Banzato	91
39	Monitoring karst aquifers	Vigna	Banzato	91
40	Artificial tracers	Vigna		63
41	Sediments in caves	Bini	Tognini	100
42	Weathering and Speleogenesis in poorly soluble rocks	Tognini	Inglese	54
43	The archaeological importance of caves	Cavanna		51
44	Palaeontology in caves	Zorzin	Bertasi, Zorzin A.	65
45	Human impact in caves	Chiesi, Badino		52

46	Management of show caves	Cigna	Badino, Chiesi	39
47	Hazard and vulnerability in karst areas	Parise		66
48	Collecting in Speleology	Marchesi	Forti, Sivelli, De Waele	61
49	Artificial caves: categories and types	Bixio Galeazzi	Basili, Del Prete, Di Labio, Forti, Germani, Guglia, Gussago, Maifredi, Mainetti, Meneghini, Parise, Saj, Traverso, Triolet J., Triolet L.	80
50	Artificial caves: physical environment and scientific research	Bixio Galeazzi	Basili, Del Prete, Di Labio, Forti, Germani, Guglia, Gussago, Maifredi, Mainetti, Meneghini, Parise, Saj, Traverso, Triolet J., Triolet L.	75
51	Artificial caves: research ambits	Bixio Galeazzi	Basili, Del Prete, Di Labio, Forti, Germani, Guglia, Gussago, Maifredi, Mainetti, Meneghini, Parise, Saj, Traverso, Triolet J., Triolet L.	103
52	Digital photography in caves	Dori	Bani, Garlasco, Maurano, Vigna	118
53	Documenting subterranean environments: video	Bernabei	Beltrame	64
54	Speleological documentation	Sivelli	Formella, Scatolini	46
55	Communicate and document speleology	Sivelli	De Waele, Goldoni, Perissinotto, Scatolini	71
56	Speleology and Parks	Chiesi	Perissinotto, Forti, Vigna, Murgia	43
57	Sight unseen: the microbial wonderland of caves	Northup, Boston		55
58	Caves and legends	Gherlizza		80

RESULTS

After almost three years of intense work a total of 58 lectures have been prepared (Table 2).

The entire package, called "Teaching resources in Speleology and Karst 2009", has been presented in an incomplete version on a DVD during the 19th International Congress of Speleology at Kerrville in July 2009 thanks to the financial support of the National Cave and Karst Research Institute of Carlsbad, USA. Since the end of the Congress a remaining part of lectures was finalised and most were translated into English, French and Spanish and have been posted on a website of the Italian Speleological Society (<http://document.speleo.it/>). After registration the lecture files can be downloaded for free.

The files are meant to be used for educational purposes at all levels, from primary schools to universities, as long as the original source is mentioned. The files may be enriched with new slides (e.g. examples of the region in which the lecture will be given) or the slides may be extracted from different presentations to compose an entirely new lecture. It is of course the responsibility of the lecturer to leave the content of the single slides unaltered. If the scientific contents of slides are changed, these modifications should be clearly reported.

All lectures can be improved adding new slides, considering new topics, changing photographs and figures and so on. It is desirable that such improvements are reported to the editor of the entire package in order to continuously update the lectures and the website. Also suggestions and constructive criticism will surely help us improving the quality of the product. Finally, the presentations may be translated into other languages such as Portuguese, German and many others. These further versions could also find a natural place in the SSI website.

CONCLUSIONS

Teaching resources in Speleology and Karst 2009 is an easily accessible, expandable and updateable set of lectures concerning karst and speleology meant to be used for teaching at various levels, ranging from the elementary school up to university classes. Lecturers and teachers may prepare their own lectures copying and pasting the slides from the original presentations and enriching them with own material and local examples. The strength of the project is its flexibility. More languages and new lecture topics may be added each year, and the existing presentations may be improved adding new photographs, correcting imprecise slides and redrawing the figures and graphs where this is retained necessary. The entire project has been published in a website of the Italian Speleological Society (<http://document.speleo.it/>) in which, after registration, all presentations in 4 languages (Italian, English, French and Spanish) can be downloaded for free.

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