

IN MEMORY OF ALFREDO BINI

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with the help of Luisa Zuccoli, Valter Maggi and Andrea Zerboni

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Alfredo Bini on a field geological campaign on Lake Garda with a group of students (courtesy of L. Zuccoli)

There are always sentiments of sadness and regret in remembering those, old masters or colleagues, who have left us, but it is especially sad and moving in commemorating colleagues and friends younger than we are, who have suddenly and unexpectedly departed, leaving in those who remain the painful and unforeseen absence of a person with whom we have shared years, interests, passions, topics of research and discussion.

Alfredo Bini suddenly died on 30 April 2015, in the Department of Earth Sciences of the University of Milan, while preparing with the colleagues field excursions for the students.

On thinking of his demise, recollections accumulated with the passing of time re-emerge to suggest where to start in a commemoration that would not be a mere, brief description of Alfredo Bini's scientific results.

In a short note it is quite difficult to fully and properly describe the amount of work done by Alfredo, now to be found in over three hundred of his publications, and come up with the most significant ones.

Alfredo Bini was born in Cairo on 8 January 1948. In October 1973, he received his degree in medicine in Milan and began a brilliant career as a researcher in the biomedical field. In the years 1974 and 1975, with a grant from the Italian National Research Council, he worked at the Pharmacology Institute of the University of Milan and published the results of his studies with his co-workers in prominent international scientific journals. But for some time his interests were focused on an entirely different world: that of karst caves. As a student, and up to his graduation, he had already published nineteen papers on caves and added another dozen while performing his post-graduate work in pharmacology.

I cannot recall the year, but it was around 1975 or 1976, when Alfredo appeared before me saying that he wanted to matriculate in geology because he wanted to study caves scientifically and full time as a geologist. I imagine that I tried to dissuade him: leaving such an important scientific sector in which he had already worked so brilliantly for one with few job opportunities seemed to be a folly. I am sure I also said that at that time the Institute of Geology in Milan had no scientific interest in speleology. But then I saw Alfredo's character, firm and decided, and I should add obstinate, if this adjective did not have a prevalently negative connotation. Alfredo graduated as a geologist in February 1982, with a thesis entitled "*Geologia e Geologia del glaciale del Monte San Primo*" (Geology and Glacial Geology of Mount San Primo). He had been obliged to accept another subject of study, but at least it was in the area of Como's prealps, where he knew every cave and ravine. Thus Alfredo began his studies on glacial deposits, which he never abandoned, as well as those on subterranean karst and speleogenesis, even trying to connect them.

He was admitted to post-graduate courses and received his doctorate in 1987, with a dissertation entitled: "*L'Apparato Glaciale Würmiano di Como*" (The Würmian Glacial System of Como). In the meantime, forging ahead in the same year, he became an associate professor of physical geography (with tenure starting from 1988) in the degree course of Geological Sciences of the University of Milan, thanks to the research activities he had been performing for more than a decade. In his CV he had some eighty papers, mostly on the subject of speleology, but also a few on the Quaternary and geomorphology of the Como region, among which the note prepared together with M.B. Cita and M. Gaetani on the hypothesis of the origin of the Italian prealpine lakes in connection with the Messinian salinity crisis (1978).

Those were the times! In those years the increase in the number of students made possible the creation of new chairs in the different disciplines and the entry of new professors. In this position of total autonomy Alfredo developed his research. Starting from his dissertation on the Como glacial deposits, he began a systematic survey of the Quaternary deposits of the large piedmont glacier systems, from that of Verbano to that of Garda and then expanded into the prealpine and alpine environments. Through a reflection on the stratigraphic criteria applicable to Quaternary continental deposits and their experimentation, Alfredo Bini has certainly made a great contribution to the affirmation in recent Italian official geological cartography of the unconformity-bounded stratigraphic units, introduced to provide major objectivity and ductility in the survey of continental deposits, also in response to the acknowledged multiplicity of glacial and interglacial climatic cycles and minor glacial oscillations.

These criteria, still in the process of being more accurately defined, were used by Bini in the Geological Map of the Province of Bergamo at the scale of 1:50,000, published in the year 2000. In his monograph of 2001, "*Geologia del Mendrisiotto (Messiniano, Pliocene, Quaternario)*" (Geology of the Mendrisio Region - Messinian, Pliocene and Quaternary) with a 1:25,000 geologic map, he clearly delineated the methods he used, described the recognized units and reconstructed the subsequent phases of glacial expansion, with sketches and detailed maps.

Bini, together with other Quaternary scientists, made numerous contributions to the definition of the guidelines and rules for the surveying of Quaternary continental deposits for the Italian Geological Service. Geological mapping experiments at the scale of 1:10,000 in different prealpine and alpine contexts, as part of the "Cartografia Geologica (CARG)" project, preceded the systematic surveys for the sheets of the 1:50,000 Italian geological map.

Alfredo Bini was the director (or supervisor) of surveys on the Neogene-Quaternary units of as many as eleven 1:50,000 geological maps, from the piedmont to the alpine sectors of Lombardy. It is known that the new Italian 1:50,000 maps have led to a decisive reassessment of Quaternary continental deposits, in the sense that much attention has been devoted to them. They are no longer considered an indistinct cover hiding the bedrock, but rather a complex and sensitive skin, varied and rich in geological information of scientific as well as practical interest. There has been a consequent explosion of units that have been recognized and mapped in the different main watersheds. While this allowed to obtain a much greater detail and objectivity (with advantages in knowledge and proper land use), it has also created difficulties in chronological and stratigraphic

attributions, correlations and syntheses.

The complexity of stratigraphic relations between the different units can be seen for example in a schematic drawing in the lower margin of Sheet 099 Iseo of the 1:50,000 geological map, which shows graphically and concisely the unconformity-bounded units, the discontinuity surfaces that delimit them, their lithology and morphology. On the Iseo sheet, mainly representing a prealpine mountainous area, about sixty bedrock units and forty continental Neogene and Quaternary units have been mapped. On the nearby Clusone sheet, thirty-three bedrock units and sixty units of surficial continental deposits have been mapped. Of these, forty-two are attributed to the Quaternary and eighteen are considered of Mio-Pliocene age. And we could continue in this way. In the illustrative notes, the chapters on the surficial deposits are just as voluminous, if not more so, than those devoted to the bedrock units.

In more recent years, Bini took an interest in the morphology and Quaternary deposits in the high alpine valleys as well, in particular in Valtellina and Val Chiavenna, on topics such as the Lateglacial, the Holocene glacier fluctuations, the deep-seated gravitational slope deformations, the evolution of the relief and so on.

It is easy to foresee that the knowledge Alfredo accumulated on Quaternary deposits and glacial history of the vast sector of the Alps he studied and surveyed will remain for a long time as a construction that cannot be overlooked by those who wish to continue these studies. The mass of analytical data that he systematically collected and described awaits a synthesis, which Alfredo has several times outlined and progressively implemented: only advances of knowledge and of dating techniques will allow to complete this work.

Together with his research and interests in the evolution of Lombardy's territory in the Quaternary, and in particular the reconstruction of the many glacial cycles and phases, Alfredo kept alive his passion and study of subterranean karst, especially in the Como Prealps. If at the beginning his production covered different topics of speleology, ranging from exploration, to morphology, mineralogy, biology, meteorology and so on, his investigations gradually became more sharply focused on the genesis of caves, their relationship with surface karst features and the evolution of regional geomorphology. To be remembered in particular are his studies, together with other colleagues, on the geochemistry and dating of cave concretions, which are important in many fields, such as neotectonic studies.

His attention was attracted especially by the karst morphology of the Grigne group (Lecco). His monograph on the Moncodeno karst is memorable, but these few lines are not sufficient to give a true idea of how much he produced in this sector. I shall cite just one final review paper by several authors on a subject that

Alfredo studied for many years. I refer to the article by Dubois et al. (2014) that appeared recently in *Earth-Science Reviews* "*The process of ghost-rock karstification and its role in the formation of cave systems*".

In this article, the development of subterranean karst systems appears not to take place by means of a single process of gradual and total removal through dissolution of carbonate rocks. There is a great deal of field evidence which instead shows a two-stage process, similar to that of deep weathering and denudation acting on insoluble rocks (e.g. granitoids). The first stage is thought to be deep chemical weathering by dissolution of the more soluble components which leaves a "ghost rock" (alterite) made of the less soluble components, separated from the unaltered rock by a sharp weathering front. The second stage, which involves increased energy of the system, is thought to lead to mechanical erosion of the "ghost rock". This is a new hypothesis which certainly finds corroboration in contexts of impure carbonate rocks such as the Moltrasio Limestone in the Como region, a deeply karstified thick well-bedded formation of clayey-siliceous limestone.

Alfredo Bini also took to heart his teaching and the dissemination of scientific information, with textbooks and popular science writings. It was in his nature to surround himself with friends and organize groups, to urge his students on through his love for his studies and his overflowing cheerfulness. Those who knew him still can hear his strong, solid voice and his disarming and loud laugh. I do not know the exact number, but I believe that Alfredo assigned and supervised a huge number of field-geology master and PhD thesis, carefully checking the geologic mapping, with great commitment and assiduity.

In the most touching tribute at the last farewell at Mandello, on 2 May 2015, with Alfredo's photographs shown in sequence on a screen (he was an excellent photographer of landscapes and portraits), his thoughts, his poems (yes, beautiful poems - I would never have imagined it!) and the testimonials of his friends, his wife Luisa read a passage from *Le Città invisibili* (Invisible Cities) by Italo Calvino, one that he loved and that reflects his way of conducting research. Here is the passage translated from the Italian:

Marco Polo describes a bridge, stone by stone.

"But which is the stone that supports the bridge?"
Kublai Khan asks.

"The bridge is not supported by one stone or another," Marco answers, *"but by the line of the arch that they form."*

Kublai Khan remains silent, reflecting. He then adds: "Why do you speak to me of the stones? it is only the arch that matters to me."

Polo replies: "Without stones there is no arch."

I recall that the classic textbook *Géologie stratigraphique* by Gignoux (the father of the Calabrian

stage), on which the geologists of my generation studied, had at the beginning of the foreword this sentence (in Italian):

Un fatto è come un sacco: vuoto, non si regge. Perché si regga, bisogna prima farci entrar dentro la ragione - Pirandello, *Sei personaggi in cerca d'autore* - (A fact is like a bag: empty it cannot stand. So that it can stand it must first be filled with reason – Pirandello, *Six Characters in Search of an Author*).

Stratigraphy is certainly based on the collection of facts, but for them to stand they need an idea that supports them, that holds them together. This was the task that Alfredo assigned to himself: that of a slow, tenacious, relentless constructor: the choice of the stones, one by one, to build a bridge that stands.

Thank you and farewell, Alfredo.

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Alfredo Bini at work on the Alps (courtesy of L. Zuccoli)