"OPERAZIONE CORNO D'AQUILIO": AN EXAMPLE OF CLEANING OPERATION, EXPLORATION AND SCIENTIFIC ANALYSIS OF A KARST SYSTEM

"OPERAZIONE CORNO D'AQUILIO": PRIMER ČISTILNE AKCIJE, RAZISKAV IN ZNANSTVENIH ANALIZ V KRAŠKEM SISTEMU

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Izvleček UDK 551.44(450)"1988/1992"

Ugo Sauro*, Marco Menichetti+ and G. Troncon++ "Operazione Corno d'Aquilio": primer čistilne akcije, raziskav in znanstvenih analiz v kraškem sistemu

"Operazione Corno d'Aquilio" je primer združenih jamarskih raziskav ter raziskovalnega projekta nekega kraškega sistema, pri katerem je sodelovalo 30 jamarskih skupin v letih 1988 - 1992. Poleg jamarskih topografskih in fotografskih raziskav v kraškem sistemu Spluga della Preta (Monti Lessini, Beneške predalpe, Italija), je bila organizirana tudi čistilna akcija. Zbranega je bilo mnogo novega znanstvenega gradiva in podatkov, zelo pomembnih za razumevanje dinamike kraškega sistema.

Ključne besede: speleologija, hidrologija krasa, prenikajoča voda, čistilna akcija, Italija, Beneške predalpe, Spluga della Preta

Abstract UDC 551.44(450)"1988/1992"

Ugo Sauro*, Marco Menichetti+ and G. Troncon++: Operazione Corno d'Aquilio: an example of cleaning operation, exploration and scientific analysis of a karst system

Operazione Corno d'Aquilio (O.C.A. Operation) is an example of integrated exploration and research project of a karst system. About 30 Speleo Groups have taken part to this project between 1988 and 1992. Beside exploration, topographical and photographical survey of the karst system of Spluga della Preta (Lessini Mountain, Venetian Pre-Alps, Italy) a cleaning operation and a lot of new scientific material spanning from geological, geomorphological, hydrological and environmental data have been collected, very important for the understanding of the character of the system.

Key words: speleology, karst hydrology, percolation water, cleaninig operation, Italy, Venetian Prealps, Spluga della Preta

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Operazione Corno d'Aquilio (O.C.A) è un interessante esempio di integrazione fra un progetto di esplorazione, un operazione di disinquinamento e la raccolta di dati scientifici su un sistema carsico. Circa 30 Gruppi Speleologici hanno preso parte a questo progetto fra il 1988 e il 1992.

Oltre all'esplorazione, al rilievo topografico e fotografico del sistema carsico della Spluga della Preta (Monti Lessini, Prealpi Venete, Italia), è stata realizzata un operazione di pulizia e raccolti materiali scientifici e nuovi dati di notevole importanza per la comprensione della dinamica dei sistemi carsici.

The speleological expedition: "Operazione Corno d'Aquilio" (O.C.A. which in Italian language means "goose") is one of the most remarkable example of an undertaking, related to a karst system, where exploration, geographical and environmental documentation, ecological restoration and educational projects have been planned and developed in co-operation between speleologists, research workers and local political Institutions.

The main focus of this project has been the karst system of Spluga della Preta, one of the world-wide known karst system, especially for the history of speleological explorations. In fact the first explorations of the system begun in the twenties and, due to an over-estimation of the real depth, during the thirties and the forties the system was considered the deepest of the World (fig. 1, 2, 3).

The early project was firstly born inside GASV (Gruppo Attività Speleologica Veronese) and GSM (Gruppo Speleologico Mantovano) during 1987. In a few months it was discussed and revised in particular by Soresini Aldo and Troncon Giuseppe.

In April 1988, 21 Speleological Groups from seven Italian regions met together and established a Commission to manage the operations, composed by a member from each Group. Also a Scientific Working Group was constituted.

Here follow the main items of the project:

1) exploration of the Preta underground system,
2) research of caves in the surrounding area,
3) unblocking of selected points of the system,
4) clean up and decontamination of the residuals of over 50 years of explorations inside the Spluga della Preta,
5) photographic survey,

6) new topographical survey of the system,
7) geological and geomorphological research inside and outside the karst system,
8) hydrological research on the area.

Giuseppe Troncon was appointed as Secretary of the OCA.

Each Speleological Group was requested to furnish material and men for the operations. The Commission remained open also to contributions of others Speleological Groups. Some political and administrative institutions were asked to support the undertaking.

During 1989 the publication of a photograph, taken during the cleaning operations, as a cover of "Speleologia", the magazine of S.S.I. (Italian Speleological Society) has given to OCA a national resonance. In fact the cleaning operation has been the largest ever realised in Italy in a large karst

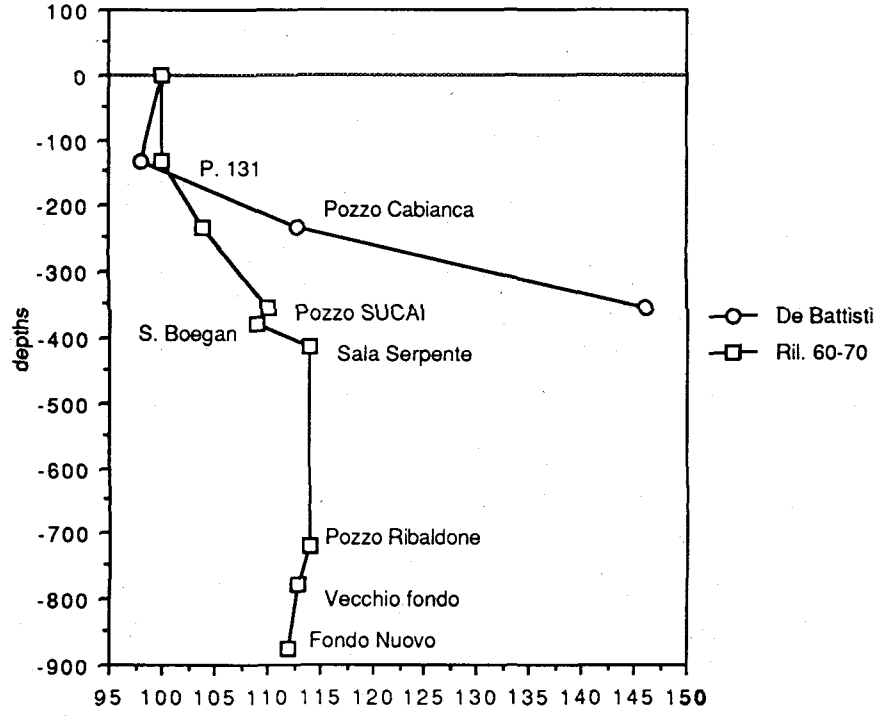

Fig. 1. - Over-estimations of some depths in old plots of Spluga della Preta (plan De Battisti of 1926; and two similar plans of 1960s) in comparison with the recent O.C.A. instrumental plot. In vertical axis the depths of the system in horizontal axis the deviations of the depths in the old plots expressed as % in comparison with the intrumental ones.

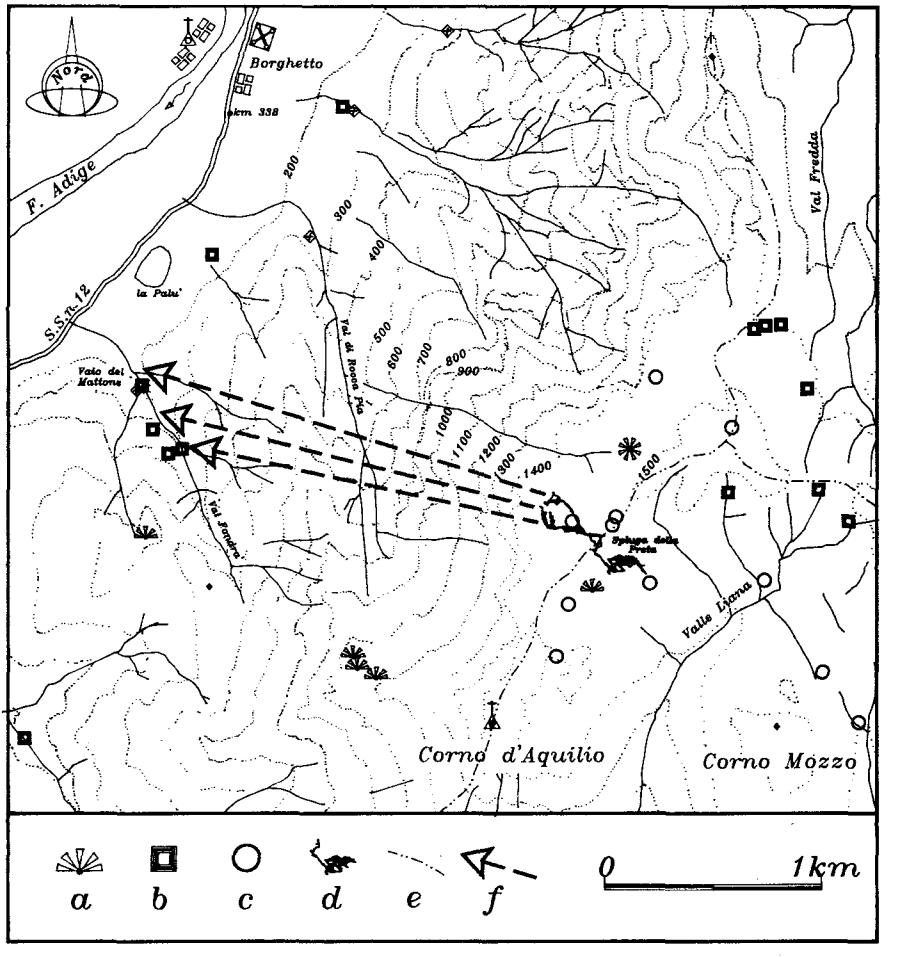

Fig. 2. - Hydrological connections of the Spluga della Preta. Legend: a) caves, b) springs, c) artificial ponds, d) topographical plot of Spluga della Preta, e) main topographical water divide, f) some subterranean water ways proved with tracing tests.

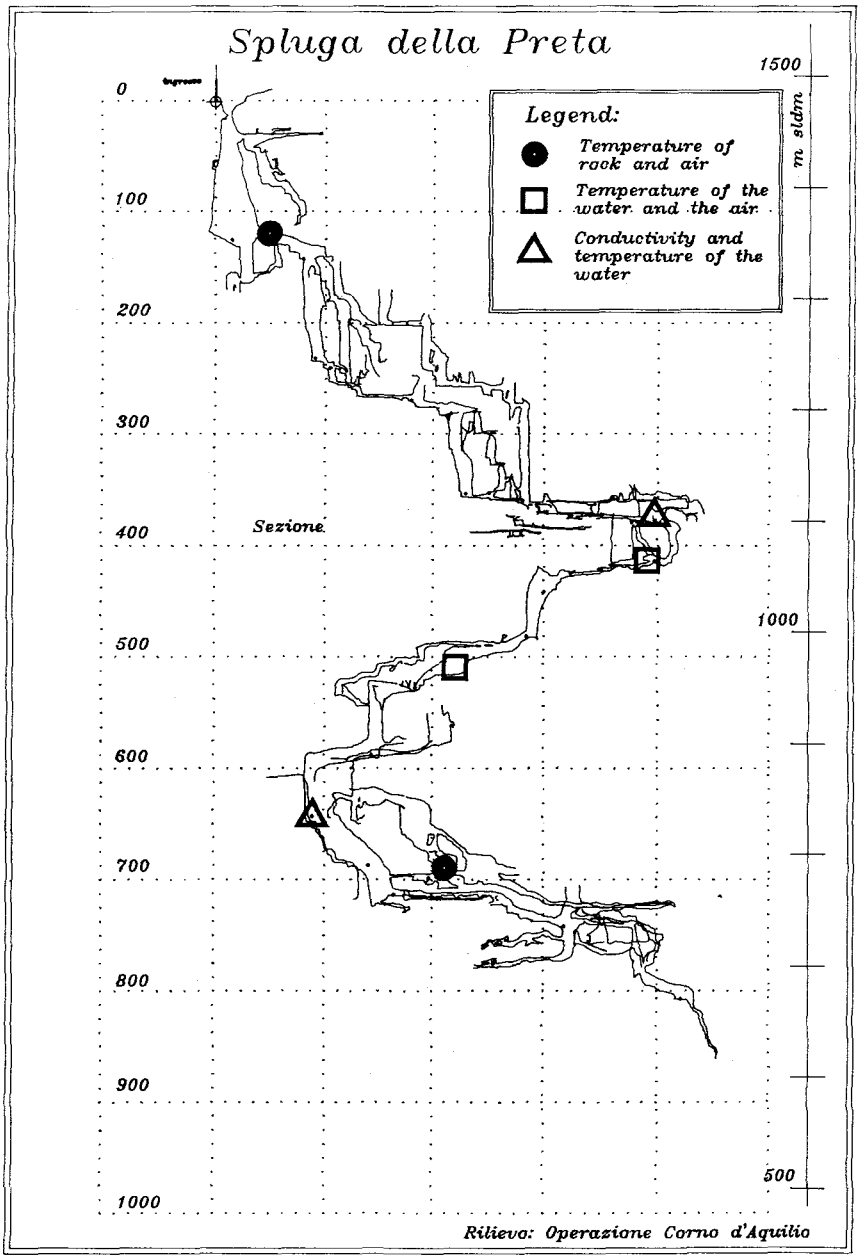

Fig. 3. - Monitoring system of environmental parameters inside the karst system of Spluga della Preta.

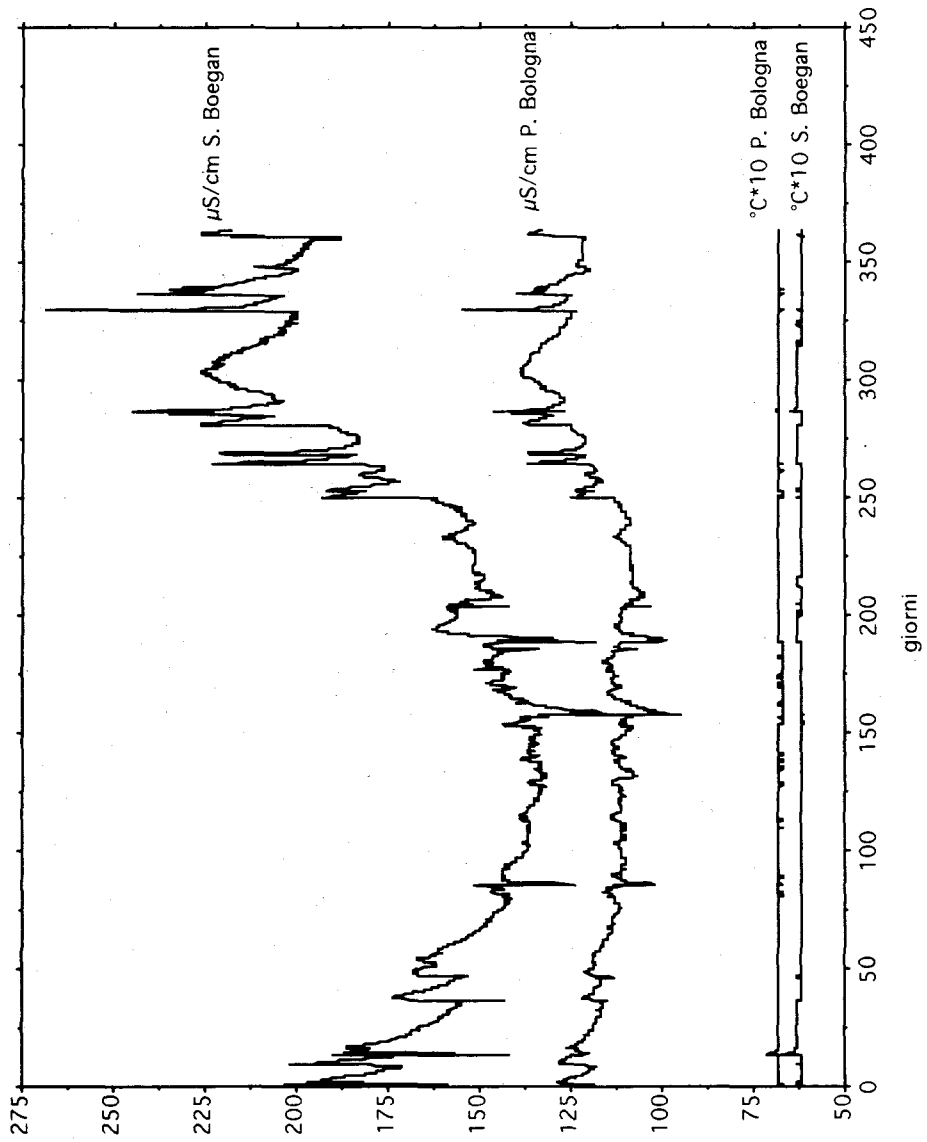

Fig. 4. - Changes in water temperature (expressed in tenths of C) and conductivity (µS/cm) at two different depths inside the karst system of the Spluga della Preta. The different amplitude of the two curves of conductivity are due to the different calibration of the sensitive elements. In the X axis there are the days from the 30th of September 1992.

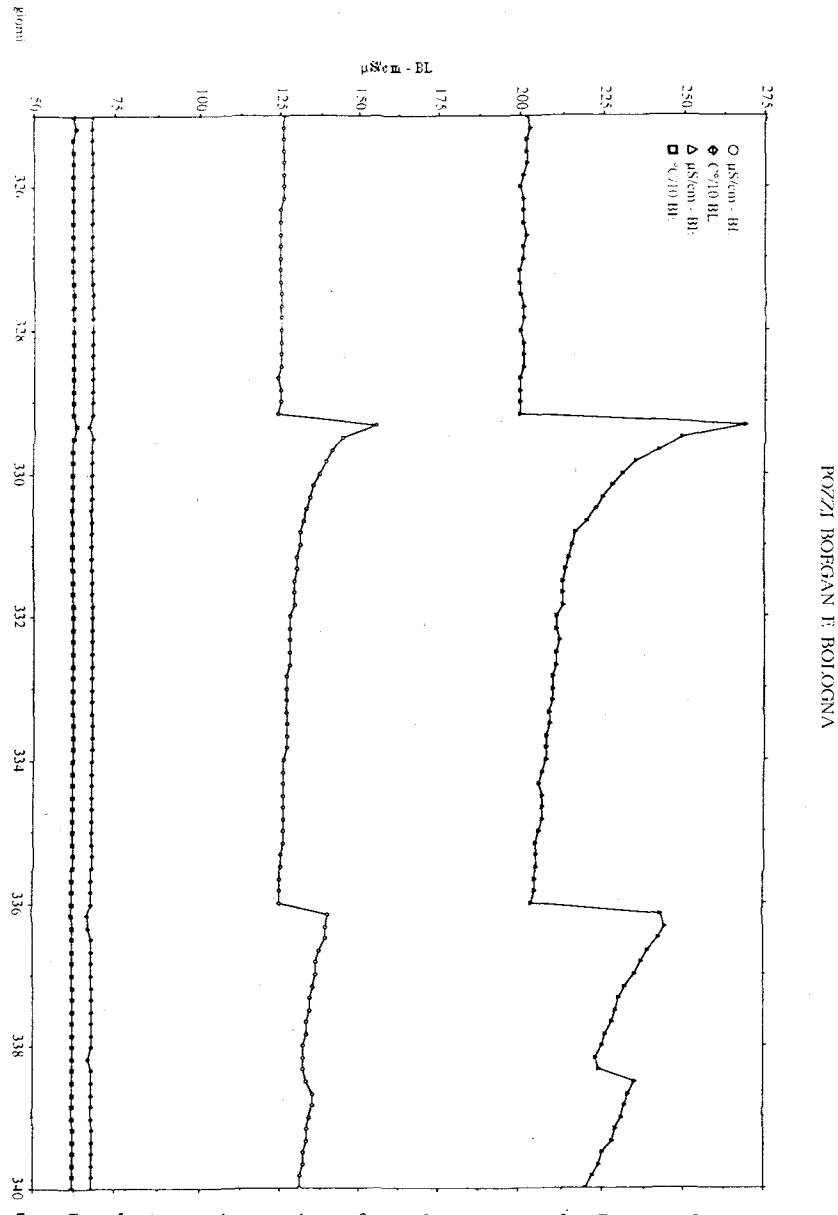

Fig. 5. - Synchronous increasing of conductivity in the Boegan Room (- 360 m) and in the Bologna Pit (- 630 m), probably linked with the rapid expulsion of the "old" water from the fissures opening near the main subterranean voids due to the piston effect inside the epikarst determined by abundant rainfalls after long period without precipitation. (326 corresponds with August 20, 1992).

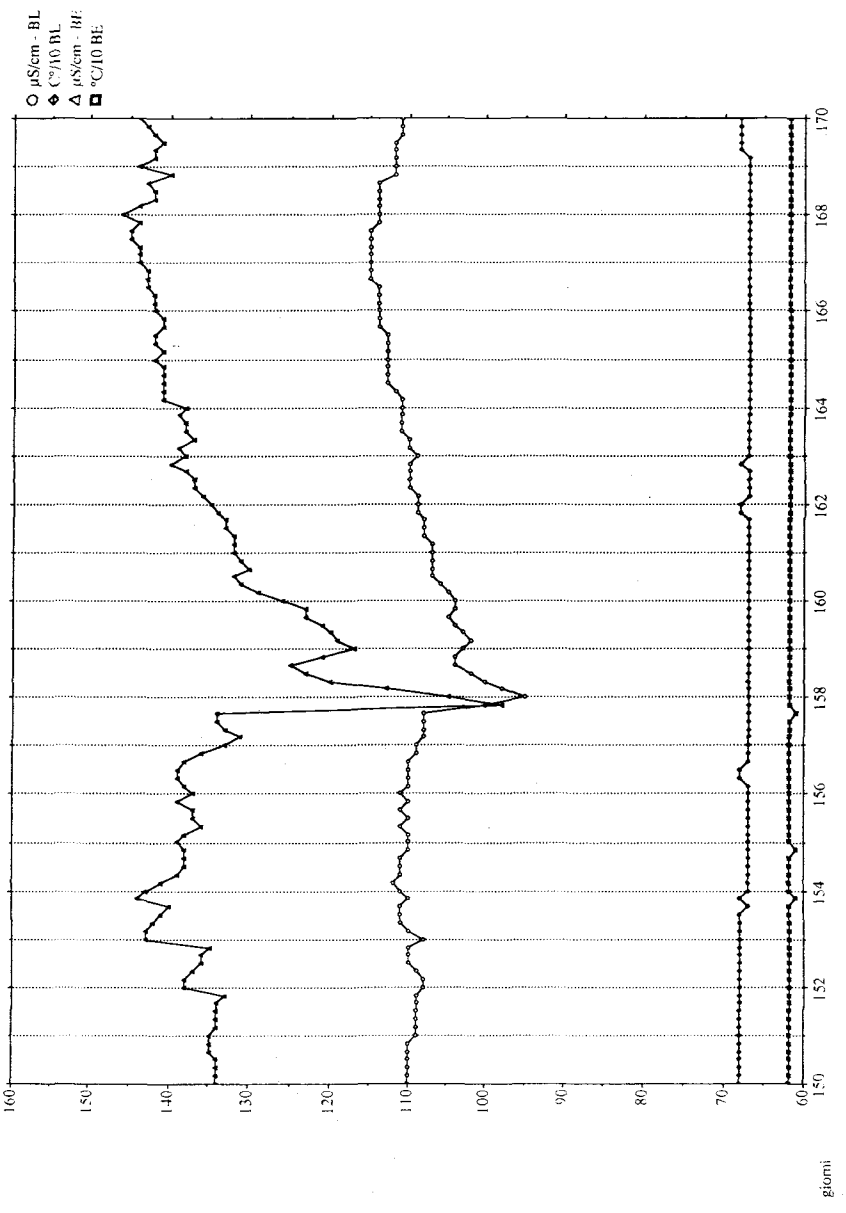

Fig. 6. - Not synchronous decrease in conductivity probably due to a flood of the underground water courses caused by snow melting (150 is February 26, 1992).

system.

After this, OCA purposes were mostly devoted to documentation and scientific research work.

The official ending of the undertaking was the 25 January 1992; in fact the operations continued for at least one more year and some are still continuing, as the publication of the documentation and the scientific results.

Searching to trace a balance of the OCA, some of the more significant points follow here:

- members of about 30 speleological groups have taken part in the operation with a total time in the cave estimated as about 30.000 hours (about 3 and half years of interrupted man-time). About half of this time was employed by the cleaning operations, during which 810 sacks of solid waste, with a total weight of about 4 MT (metric tons) were transported to the surface,
- from the exploitive point of view about one kilometre was added to the development of the cave, beside the 2,5 km previously explored,
- a new precise topographical survey was made, which has allowed correction of the total difference in elevation of the system to 875 m, against the 985 m previously estimated (fig. 1, 3),
- a photo-survey of about 5000 photographs was made,
- unknown karst caves in the surrounding areas were detected and explored,

With reference to the scientific research work the main results are listed below:

- new geologic surveys both of the area and of the underground system,
- geomorphological survey,
- analyses of the underground sediments (difractometry, pollen research, ...),
- thermal infrared analysis of the Adige Valley left slope, near to the karst system,
- tracing tests to recognise both the hydrological connection with karst springs and the main internal network of the karst water (fig. 2),
- chemical analyses of the karst water,
- monitoring for one year of some parameters (temperatures of the air, water, rock, conductivity) inside the system (fig. 3);
- biological researches during which some new species of invertebrate were discovered.

With reference to the monitoring operations, the air temperature was measured at the surface of the plateau, the bottom of P. 131, the Serpenti room, the Bertola Room, and the Vecchio Trippa branch; the water temperature was measured in the Serpenti room, and in the Bertola Room; the rock temperature was measured at the base of P. 131 and the Vecchio Trippa branch. The water conductivity was measured in the Boegan room and in the Bologna Pit (fig. 3).

In this way about 20.000 data were collected (about 2000 for each station with a lapse of 4 hours for the time of about 1 year).

It will take a long time to examine all these data. Here we make only some preliminary observations.

The temperature curves do not show significant changes between the different components of the system. The air temperature vertical rate is of about 0,4 C/100 m; the water temperature vertical rate is of only 0,22 C. A curious variation of temperature during springtime has been observed at the base of P. 131. If this change is confirmed by further work it could perhaps be explained by a chimney effect due to the warmer air coming from the well exposed rocky bluffs of the nearby slope of the Adige Valley. The starting of this chimney effect could perhaps be determined by the piston effect inside the epikarst of the snow melt water combined with the spring rainfalls.

Very interesting are the curves of the water conductivity measured in the Boegan room (- 380 m) and in the Bologna Pit (- 640 m).

The differences in conductivity between the two curves are not real and mostly due to the different sensitivity ranges of the electrodes.

Between the many observations deducible from the analysis of the curves these are noteworthy:

- an annual cycle of conductivity is clearly recognisable linked with the runoff regime (fig. 4);
- some rapid increases in conductivity are nearly synchronous in the two station and probably linked with the rapid expulsion of the "old" water from the fissures opening near the main subterranean voids due to the piston effect inside the epykarst, determined by abundant rainfalls after long period without precipitation (fig. 5);
- on the contrary there is a lapse time of about 4-12 hours in the decreasing of conductivity between the two stations; this is clearly linked with the arrival of younger water during the flooding of the underground water courses.

Surely many of these aspects necessitate further research work (fig. 6).

In any case OCA is a good example of an undertaking developed in co-operation between speleologists and research workers which has allowed both an ecological restoration of a large karst system and the storing of a lot of new data and unexpected scientific results.

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"OPERAZIONE CORNO D'AQUILIO": PRIMER ČISTILNE AKCIJE, RAZISKAV IN ZNANSTVENIH ANALIZ V KRAŠKEM SISTEMU

Povzetek

"Operazione Corno d' Aquilio" je primer združenih jamarskih raziskav ter raziskovalnega projekta nekega kraškega sistema. Akcija je bila usmerjena v brezno Spluga della Preta (Monti Lessini, Beneške predalpe, Italija), ki je nekaj časa veljalo celo za najgloblje na svetu. 1988 se je zbralo 21 jamarskih skupin in izbralo posebno komisijo za vodenje akcije ter sestavilo delovno skupino znanstvenikov. Akcija je bila uradno zaključena 25. januarja 1992. Tekom akcije so bili člani 30 jamarskih skupin okoli 30 000 ur pod zemljo (polovico časa so porabili za čiščenje - na površje so zvlekli 810 vreč, okoli 4 tone, trdnih odpadkov). Izmerili so okoli 1 km novih rovov (prej je bilo brezno dolgo 2,5 km), napravili nov natančen načrt (po njem je globina 875 m, prej 985 m), posneli okoli 5 000 fotografij in preiskali okoliški kras.

Najpomembnejši rezultati znanstvenih raziskav so geološke raziskave brezna in okolice, geomorfološki pregled, analize sedimentov, infrardeče termoanalize bližnjega pobočja, sledenje vode, kemijske analize kraške vode, leto dni trajajoč monitoring v breznu (temperature zraka, vode in skale, električna prevodnost) in biološke raziskave, ki so odkrile nekaj novih vrst nevretenčarjev.

Operacija "Corno d'Aquilio" je lep primer sodelovanja med jamarji in znanstveniki, ki je omogočilo ekološko sanacijo velikega kraškega sistema, tekom akcije pa je bilo zbranih veliko novih podatkov, ki so dali tudi nepričakovane znanstvene rezultate.