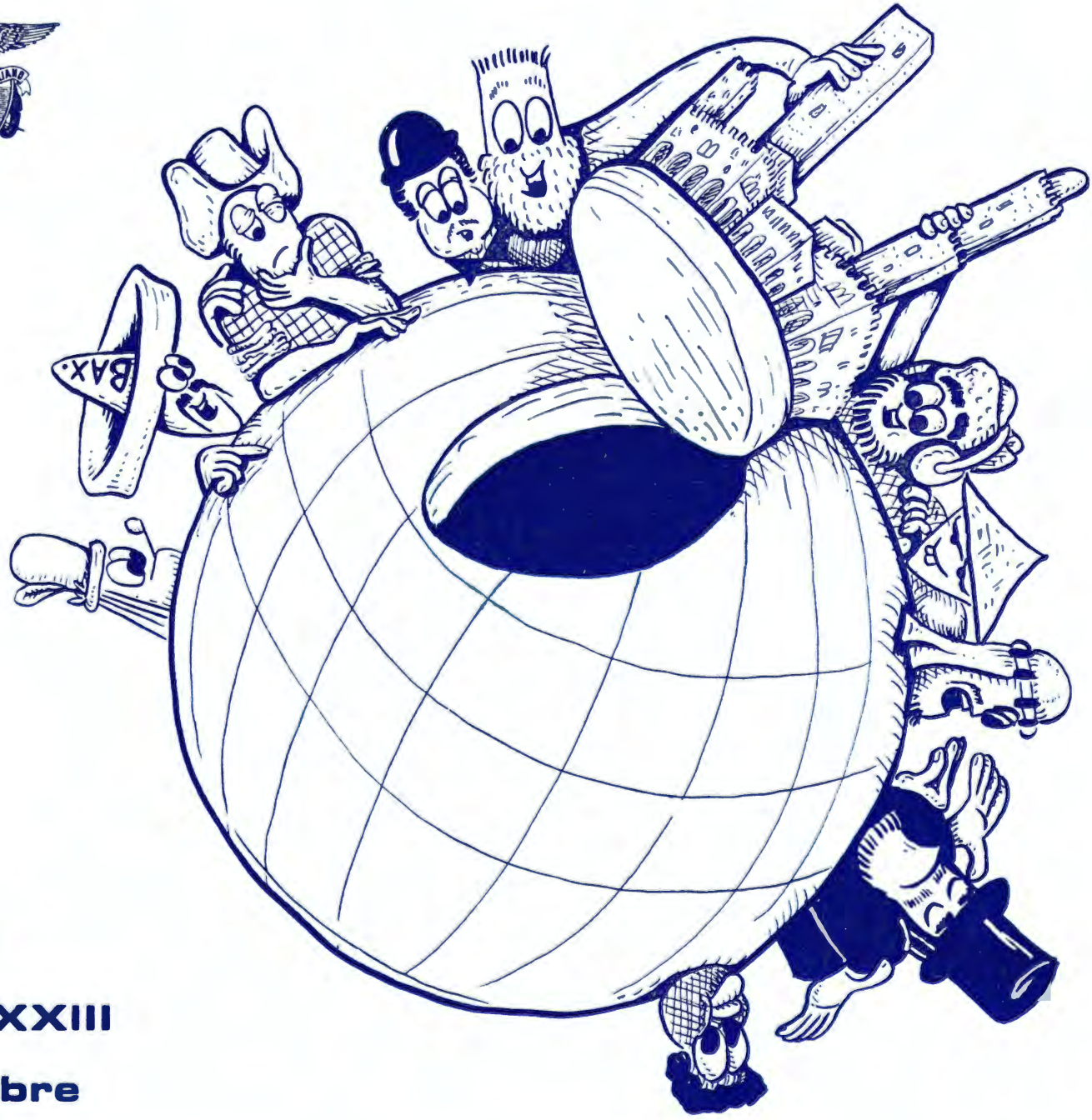
SOTTOTERRA

Rivista quadrimestrale di speleologia del Gruppo Speleologico Bolognese C. A. I.



69

anno XXIII

dicembre 1984

G.S.B. del CAI

Fondato nel 1932 da Luigi Fantini.
Aderente alla Società Speleologica Italiana
Membro della Federazione Speleologica
Regionale dell'Emilia e Romagna

Rivista di Speleologia del
Gruppo Speleologico Bolognese del C.A.I.

Anno XXIII n. 69 - Dicembre 1984

SIMPOSIO INTERNAZIONALE SUL CARSISMO NELLE EVAPORITI

22 - 25 Ottobre 1985

FEDERAZIONE SPELEOLOGICA REGIONALE
DELL'EMILIA-ROMAGNA
ISTITUTO ITALIANO DI SPELEOLOGIA

Si era detto che il n. 69 di Sottoterra sarebbe stato eccellente, speciale, del tutto anomalo, e pubblicato entro l'85; e così è.

Si tratta della ristampa dei Preprints del Simposio Internazionale sul Carsismo nelle evaporiti, Convegno che vedrà riuniti, per la prima volta nel mondo, gli speleologi e gli studiosi di questo particolare fenomeno.

Le più recenti opere di sintesi circa le conoscenze sulle aree carsiche gessose in Italia risalgono a prima degli anni '20. Per oltre mezzo secolo, quindi, i risultati dei grandi progressi negli studi speleologici in questo particolare campo di indagine si sono dispersi in molti piccoli rivoli, di difficile se non impossibile consultazione.

La Redazione ha pertanto ritenuto utile proporre all'ormai vasto pubblico dei suoi lettori i riassunti delle comunicazioni che verranno presentate al Simposio, per diffondere notizie e ricerche che altrimenti rischierebbero di rimanere confinate nel ristretto ambito Accademico.

Cogliamo l'occasione per ringraziare l'Istituto Italiano di Speleologia e l'instancabile organizzatore del Simposio, Paolo Forti, al cui impegno e alla cui incondizionata collaborazione dobbiamo questo numero.

PAOLO GRIMANDI

« Quella meravigliosa fonte, et origine, di dove scaturisce, quell'acqua abbondantissima salata, che con si gran violenza fà macinar quel Molino... »

da: Cosimo Bottegari 1612, « Relazione d'un suo viaggio all'acqua salata di Minozzo in quel di Reggio (Modena) ».

Per la prima volta un gruppo di studiosi provenienti dalle diverse parti del mondo si trovano riuniti per discutere i problemi relativi ai fenomeni carsici nelle rocce evaporitiche. L'occasione del 1° Simposio Internazionale sul Carsismo nelle Evaporiti consentirà di mettere a confronto le molteplici esperienze di ricerca in questo campo, e di portare un valido contributo alla conscenza dei processi genetici ed evolutivi di questa particolare forma di carsismo.

Ciò è tanto più significativo in quanto finora l'interesse per l'argomento è rimasto per lo più circoscritto ad ambiti ristretti, anche — soprattutto per quanto riguarda l'Italia — in conseguenza della limitata estensione territoriale di queste formazioni.

La scelta di Bologna come sede del Simposio non è casuale: i dintorni della Città sono interessati da importanti fenomeni epigei ed ipogei nelle evaporiti, che da tempo sono stati oggetto di ricerche naturalistiche, geologiche e soprattutto speleologiche; la miocenica « Vena del Gesso Romagnola », che si estende verso est nel basso Appennino per una ventina di chilometri, presenta notevole interesse sia per lo studio delle varie forme di carsismo che per gli aspetti peculiari riguardo ai caratteri morfologici e fitogeografici e per le diverse utilizzazioni da parte dell'uomo fin dai tempi preistorici.

La rassegna delle comunicazioni presentate al Simposio — qui raccolte a cura del prof. Paolo Forti e pubblicate con il contributo del Dipartimento di Geografia — offre un panorama degli interessi interdisciplinari che confluiscono sul tema specifico. I lavori di questa prima assise internazionale consentiranno di fare il punto sugli studi compiuti nell'ultimo ventennio e saranno una utile base di partenza per le ricerche future.

Nell'esprimere la certezza che il Simposio, per l'alta qualificazione scientifica dei partecipanti, conseguirà importanti risultati, porgo a tutti i Colleghi qui convenuti un cordiale benvenuto.

Prof. MARIA ROSA PRETE
Direttore del Dipartimento di Geografia
dell'Università di Bologna

PROGRAMMA - PROGRAM

21 Ottobre 1985 - **registrazione - registration**

16.00 Apertura della segreteria - Opening of the Registration office: Istituto di Geologia - Via Zamboni 67.
Arrivo dei Partecipanti a Bologna e registrazione, sistemazione in Hotel.
Arrival of partecipants, registration and hotel assignment.

20.00 Cena - Dinner.

22.00 Chiusura della segreteria.

22 Ottobre 1985 - **Escursione ai fenomeni carsici dell'alta Val di Secchia**
Fieldtrip to karst phenomena in the Upper Secchia Valley

6.45 Partenza in pullman dal piazzale antistante l'Istituto di Geologia.

L'escursione avrà come meta i fenomeni carsici epigei ed ipogei nelle formazioni evaporitiche triassiche.

— Visita alla grotta « Tanone Grande della Gacciolina » (ansa ipogea attiva, che verrà percorsa per circa 500 metri). La grotta è di facile percorribilità; sono consigliati stivali, casco con luce indipendente ed un completo cambio d'abiti, dato che all'interno scorre un torrente attivo.

— Visita esterna ai fenomeni superficiali (doline, inghiottitoi, risorgenti).

6.45 The excursion bus will start from the square in front of the Institute of Geology.

The excursion will bring the participants to visit surface and deep karst features in the Triassic evaporite formations.

— External trip to subaereal karst phenomena (sinkholes, springs etc.).

— Trip to the « Tanone Grande della Gacciolina » cave (an active hypogean bught, which will be visited for about 500 m). The cave is horizontal and easy; requested equipment: boots, hard cap with electric or acetilene lamp. It is also suggested to bring a full dress change because inside the cave

— Visita alle Fonti di Poiano, che sono le più grandi risorgenti carsiche dell'Emilia-Romagna.

Durante l'escursione verrà fatto uno stop per permettere la degustazione di specialità gastronomiche locali.

— Trip to the « Fonti di Poiano » salt springs, which are the largest karst springs of the Emilia-Romagna region.

During the excursion a stop will be done to allow the participants to taste local foods.

21.00 Rientro a Bologna - Return to Bologna.

23 Ottobre 1985 - **Sedute scientifiche - Scientific sessions**
Istituto di Geologia dell'Università di Bologna

8,30 Apertura ufficiale del Symposio - Official opening.

8,40 BERTOLANI M. *Speleological research in the Emilia-Romagna region: an overview.*

9.00 **Il carsismo nei gessi triassici dell'Emilia-Romagna - Triassic Gypsum karst in the Emilia-Romagna region**

9.00 CATELLANI C., FORMELLA W. *Statistic analysis of the cavities in the triassic evaporites of the upper Secchia valley, according to some new discoveries.*

9.20 COLOMBETTI A. *Il ritrovamento, durante la perforazione di un pozzo nell'alveo del F. Secchia, di salgemma nella formazione dei gessi triassici di Burano (Villaminozzo, Reggio Emilia).*

9.40 BERTOLANI M., ROSSI A. *Petrografia del « Tanone della Gaggiolina » (Reggio Emilia, Italia).*

10.00 GORGONI C., ROSSI A., GADDI E. *Dati geochimici relativi a rocce evaporitiche dell'Emilia-Romagna (Italia).*

10.20 CHIESI M. *Genesis and development of « hypogea bends » peculiars to karst cavities in the triassic evaporite formation.*

10.40 Intervallo - Break.

11.00 CHIESI M. *Speleothems and secondary mineralisations of the « Inghiottitoio dei Tramonti », the largest Emilian cave in triassic evaporite.*

11.20 FERRARI C., FORMELLA W. *Hydrogeology of « Ca' Scaparra » and « Ca' Speranza » karst systems - Messinian gypsum formation.*

11.40 FORTI P., FRANCAVILLA F., PRATA E., RABBI E., CHIESI M. *Hydrogeology and hydrogeochemistry of the Triassic evaporites in the upper Secchia valley (Reggio Emilia, Italy) and the Poiano karst springs.*

12.00 BERTOLANI MARCHETTI D. *Vegetation features in the triassic evaporitic formation of the upper Secchia valley.*

12.20 NIMIS P.L., DALLAI D. *Lichens of hypogaeic cavities in the appennines of Reggio Emilia (Italy).*

13.00 Pranzo - Luch.

14.20 **Il carsismo nei gessi messiniani dell'Emilia-Romagna - Messinian gypsum karst in the Emilia-Romagna region**

14.20 BENTINI L., COSTA G.P., EVILIO R. *Note preliminari sull'abisso G. Mornig (11 E/Ra) e sull'idrologia carsica dei « Gessi di Rontana e Castelnuovo » nella Vena del Gesso Romagnola.*

14.40 FRANCAVILLA F., FORTI P., PRATA E., RABBI E. *Hydrogeology and hydrogeochemistry of the « Rio Stella - Rio Basino » karst system (Riolo Terme, Italy).*

15.00 COSTA L., COLALONGO M.L., DE GIULI C., MARABINI S., TORRE D., VAI G.B. *Latest messinian vertebrate fauna preserved in a paleokarst - neptunian dyke setting (Brisighella Northern Italy).*

15.20 BELVEDERI G., GARBERI M.L., *Preliminar observation on the relationships between tectonic structure and genetical development of the gypsum karst cavities (Farneto, Bologna, Italy).*

15.40 BRINI M., GRIMANDI P. *Osservazioni sulla morfologia dei grandi Canali di Volta presenti nel piano superiore della Grotta della Spipola (Bologna, Italia).*

16.00 BRINI M., FABBRI M., FRABETTI P.G., GRIMANDI P. *Recenti esplorazioni nel complesso Spipola-Acquafredda (Bologna, Italia).*

16.20 FINOTELLI F., GIRALDI E., PINI G.A. *Genetical analysis of the natural cavities in the messinian evaporites near Bologna (Italy).*

16.40 NANETTI P. *Difficulties and techniques of progression in the Emilia-Romagna messinian gypsum caves (Italy).*

17.00 Intervallo - Break.

17.20 FORTI P., GRIMANDI P. *The Spipola cave touristization inside the Gessi Bolognesi regional park.*

17.40 P. GRIMANDI. *Problems of environmental preservation in the Emilia-Romagna messinian gypsum (Italy).*

18.00 **Il carsismo nelle evaporiti Italiane - Evaporite karst in Italy**

18.00 ABBATE R., MARINO A. *Le attuali conoscenze sul carsismo nel le aree gessose della Sicilia.*
18.20 AGOSTINI S., FASCIANI M., ROSSI M.A. *Il carsismo nei gessi alto miocenici di S. Valentino (Abruzzo).*
18.40 FORTI P. *Speleothems and cave minerals of the gypsum karst of the Emilia-Romagna region (Italy).*
19.00 FORTI P., POSTPISCHL D. *Relazioni esistenti tra terremoti storici e deviazioni negli assi delle stalagmiti: dati preliminari dalle grotte di Bologna (Italia).*
19.20 CARULLI G.B., CUCCHI F., GIORGETTI F. *Gypsum solution into alluvial deposits.*

20.00 Cena - Dinner.

21.00 **Proiezione di Films e Audiovisivi - Slides and Films presentation**
Istituto di Geologia dell'Università di Bologna.

24 Ottobre 1985 - **Sedute scientifiche - Scientific sessions**
Istituto di Geologia dell'Università di Bologna.

8.20 **Il carsismo nelle evaporiti nel mondo - Evaporite karst in the World**

8,20 CHOPPY J. *Curieuse destinee d'un mot: le parakarst.*
8.40 CHOPPY J., CALLOT Y. *Karsts des evaporites de l'Oranais (Algerie).*
9.00 CIGNA A.A. *Some remarks on phase equilibria of evaporites and other karstifiable rocks.*
9.20 BUZIO A., *Presentazione del volume sui fenomeni carsici in sale del Monte Sedom in Israele.*
9.40 DUBLJANSKY V.N., KLIMCHOUK A. *Genesis and development history of the large gypspum caves in the Western Ukraine.*

10.00 Intervallo - Break.

10.20 DURAN VALSERO J.J., BURILLO PANIVINO F.J. *Characterization of gypsum karst in Spain, its relationship with stratigraphic and structural conditions.*

10.40 DURAN VALSERO J.J., BURILLO PANIVINO F.J. *Triassic gypsum karst of the Loma del Yesar (Archidona, Malaga, Southern Spain).*

11.00 KLIMCHOUK A.B., ANDREICHOUK V.N. *Geological and hydrogeological conditions of gypsum karst development in the Western Ukraine.*

11.20 KLIMCHOUK A.B. *Karst caves in gypsum on the USSR territory.*

11.40 KOSA A. *Morphogenesis of the Bir al Ghanam karst (Libya).*

12.30 Pranzo - Dinner.

14.20 **Il carsismo nelle evaporiti del mondo - Evaporite karst in the World**

14.20 LISZKOWSKA E. *The influence of the evaporite beds on the chemistry and vertical chemical zonality of groundwaters: a case history from Poland.*

14.40 LISZKOWSKI J. *Mechanisms and kinematics of sinkhohles development of gypsum karst in Poland.*

15.00 PECHORKIN I.A. *Engineering geological investigations of gypsum karst.*

15.20 PECHORKIN I.A. *On gypsum and anhydrite distribution in near-surface zones of sulphate massifs.*

15.40 PECHORKIN I.A. *Interconnection between long sulphate karst cave systems and tectonic jointing distribution.*

16.00 Intervallo - Break.

16.20 PHILIPPOV A.G., PHON DER PHLAHS G.S., NICULIN V.I. *Salt karst related to iron-bearing pipes.*

16.40 PULINA M., LISZKOWSKI J. *Distribution and practical aspects of the evaporite karst in Poland.*

17.00 QUINLAN J.F. *Gypsum karst and salt karst of the United States.*

17.20 YUAN DAOXIAN. *Evaporite karst in China.*

17.40 ZAKOPLETOV V.E., SHULTANOV V.M. *The experience of study of removal of karst and suffosion cavities filling material in laboratory and in situ experiments.*

18.00 BENAVENTE HERRERA PJ., CARRASCO CANTOS F. *Influence of evaporite karst in the streamwater quality of Guadalhorce river (Andalucia, Spain).*

18.20 GUAN YUHUA, SONG LIN HUA. *Salt karst in Qinghai plateau, china.*

20.00 Cena di chiusura - Official dinner.

25 Ottobre 1985 - **Escursione ai fenomeni carsici della Vena del Gesso Romagnola**

Fieldtrip to karst phenomena in the «Vena del Gesso Romagnola»

6.45 Partenza in pullman dal piazzale antistante l'Istituto di Geologia.

L'escursione avrà come meta i fenomeni carsici ipogei ed epigei nelle formazioni evaporitiche mioceniche.

L'escursione inizierà con una breve visita alla cittadina di Brisighella da cui si partirà per raggiungere gli affioramenti dei gessi e la vicina cava di gesso del « Monticino », nella quale è stato rinvenuto recentemente un riempimento carsico fossilifero del Mio/Pliocene. Si visiteranno i «Buchi della Volpe » e quindi seguirà la visita ai fenomeni carsici esterni nella zona dell'« Abisso Fentini ».

L'escursione terminerà alla «Tana del Re Tiberio » ove si avrà la possibilità di osservare i riempimenti archeologici della cavità e le sottostanti gallerie artificiali della cava ANIC.

Durante l'escursione verrà fatto uno stop per permettere la degustazione di specialità gastronomiche locali.

6.45 Start of the excursion bus from the square in front of the institute of Geology.

The tour will begin with a short visit to the small town of Brisighella, from which the excursion over the messinian gypsum outcrop will start. In the « Monticino » quarry will be possible to see the fossil fillings of a karst of Mio/pliocene age. After an external overview of the « Buchi della Volpe » sinkhole, te epigean karst morphologies of the « Vena del Gesso Romagnola » close to the « Fantini » pothole will be seen. Lastly the participants will have the possibility to visit the «Re Tiberio » cave and the ANIC gypsum quarry which intersected the cavity.

During the excursion a stop will be made to allow the participants to taste local foods.

20.00 Rientro a Bologna - cena.
Return to Bologna - Dinner.

22.00 Partenza col treno e cuccette dei partecipanti all'escursione in Sicilia.
Start by sleeping-car to the fieldtrip in Sicily.

26 Ottobre 1985 - **Escursione ai fenomeni carsici del Parco dei Gessi Bolognesi**
Fieldtrip to the karst phenomena in the « Parco dei Gessi Bolognesi »

7.30 Partenza con auto private dal piazzale antistante l'Istituto di Geologia.

L'escursione permetterà di visitare parte della più grande grotta in gesso dell'Europa Occidentale: il sistema Spipola-Acquafredda. Inoltre sarà fato un breve giro esterno nella zona più interessante del « Parco dei Gessi Bolognesi ».

7.30 Start with private cars from the square in front of the Institute of Geology.

The trip will allow the participants to visit a part of the largest gypsum cave of the West Europe: the Spipola-Acqua Fredda system. Then an external trip will be done inside the most interesting part of the « Gessi Bolognesi » regional park.

14.30 Pranzo al sacco e termine dell'escursione.
Picnic and end of the excursion.

27-30 Ottobre 1985 - **Escursione ai fenomeni carsici nelle evaporiti Siciliane**

Il Comitato organizzatore si riserva il diritto di modificare in qualunque momento il presente programma in funzione delle necessità organizzative.

The Organizing Committee is free to change at any time the present program.

SPELEOLOGICAL RESEARCH IN THE EMILIA-ROMAGNA REGION: AN OVERVIEW

M. BERTOLANI [1]

In the present paper, starting from the first signallings, pioneeristic explorations of caves and researches on karst features, the up today speleological activities in the Emilia-Romagna region are shortly outlined.

Among them are worth of mention the foundation of the « Società Speleologica Italiana» in Bologna in 1903 and its magazine « Rivista Italiana di Speleologia »; the birth in 1931 of the « Gruppo speleologico Emiliano-Romagnolo », the first caving club of the Region; the co-ordination of the regional speleological activities through the « Commissione Catastale »; and finally the foundation of the « Federazione Speleologica Regionale dell'Emilia-Romagna », which allowed a deep and usefull co-operation with the regional government mainly in the fields of landscape safeguard and educational and recreational utilization of the karst areas.

The principal explorations and the main authors both for the pioneeristic and recent period are also recalled.

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[1] Presidente della Federazione Speleologica Regionale dell'Emilia-Romagna

IL CARSISMO NEI GESSI TRIASSICI DELL'EMILIA-ROMAGNA
TRIASSIC GYPSUM KARST IN THE EMILIA-ROMAGNA REGION

« STATISTIC ANALYSIS OF THE CAVITIES IN THE TRIASSIC EVAPORITES OF HIGH SECCHIA VALLEY, ACCORDING TO SOME NEW DISCOVERIES »

CLAUDIO CATELLANI, WILLIAM FORMELLA [1]

In the present paper we analyze the cave sistems explored in the most imposing and homogeneous sector of the high Secchia valley evaporites.

This sector is bounded to the north by the « Poiano » springs (Villa Minozzo) and to the South by the Talada brook (Busana).

Systematic exploration led by G.S.P.G.C. in 1984 have brought forth and up-to-date vision of the speleothems and have provided new data which are now registered in the Speleologycal Cadastre.

We analyze, in statistic terms, the following aspects: position and distribution of the caves into the studied area; morfology, speleogenesis and hydrology of the cavities.

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[1] Gruppo Speleologico Paletnologico « G. Chierici » di Reggio Emilia.

« IL RITROVAMENTO DURANTE LA PERFORAZIONE DI UN POZZO NELL'ALVEO DEL F. SECCHIA DI SALGEMMA NELLA FORMAZIONE DEI GESSI TRIASSICI DI BURANO (Villaminozzo - R.E.) »

A. COLOMBETTI [1]

La perforazione di un pozzo esplorativo nell'alveo del F. Secchia,

spinto sino ad una profondità di 100 metri dal piano di campagna, ha attraversato per circa 50 metri i gessi triassici. La roccia attraversata è costituita principalmente da gesso con varie percentuali di dolomite e calcite con vario grado di compattezza per la presenza di fenomeni di dissoluzione.

Alla profondità di circa 90 metri dal piano di campagna si sono incontrati livelletti di salgemma, intercalati al gesso ed alla dolomite.

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(1) Università degli Studi di Modena - Istituto di Geologia.

« PETROGRAFIA DEL "TANONE GRANDE DELLA GAGGIOLINA" » (Reggio Emilia - Italy)

MARIO BERTOLANI (1), ANTONIO ROSSI (1)

Il « Tanone Grande della Gaggiolina » (154 E/RE) è costituito da una grande caverna che dà accesso ad un torrente sotterraneo percorribile per circa 400 metri. Si sviluppa nelle Evaporiti Triassiche dell'Alta Valle del Fiume Secchia che sono costituite essenzialmente da gessi, anidriti e dolomie; a queste rocce se ne aggiungono altre, legate a fenomeni di trasformazione o a inserimenti tettonici.

La stratigrafia complessa e tormentata e la diversa carsificabilità delle rocce incontrate dal torrente ipogeo provocano una morfologia estremamente varia e suggestiva.

Le due possibilità che ha il sistema carsico sotterraneo di funzionare da drenaggio della soprastante montagna e di inghiottire acque dal Torrente Sologno, affluente del Fiume Secchia, portano alla esistenza in grotta di due apporti di sedimento: uno proveniente dal bacino imbrifero esterno, l'altro dal sistema carsico interno.

Il presente studio prende in esame, nelle loro caratteristiche petrografiche le rocce carsificate le quali, attraverso diversi stadi di trasformazione progressiva, tendono alla completa gessificazione. Sono stati pure studiati i sedimenti interni, clastici e chimici, rappresentati da limi più o meno sabbiosi od argillosi e da concrezioni calcaree appartenenti a fasi diverse di deposizione.

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(1) Istituto di Mineralogia e Petrologia, Università degli Studi, Gruppo Speleologico Emiliano C.A.I., Sez. di Modena.

« DATI GEOCHIMICI PRELIMINARI RELATIVI A ROCCE EVAPORITICHE DELL'EMILIA-ROMAGNA (ITALY) »

CARLO GORGONI [1], ANTONIO ROSSI [2] e ELISABETTA GADDI [1]

In questa prima fase della ricerca sono state messe a punto alcune metodologie analitiche per la determinazione di vari elementi minori ed in traccia, presenti in campioni di diversi affioramenti evaporitici emiliano-romagnoli. Formazione Gessoso-Solfifera del Messiniano ed Evaporiti del Trias, che hanno permesso di presentare alcuni dati preliminari sulla distribuzione di tali elementi.

Lo scopo di questa ricerca è quello di discriminare la distribuzione geochimica dei vari elementi considerati tra i minerali propriamente evaporitici e quelli di genesi diversa, utilizzando metodologie di attacco chimico selettivo e, possibilmente, di risalire all'ambiente geochimico di formazione e ai meccanismi genetici dei materiali considerati, oltre che di evidenziare l'esistenza di possibili fenomeni evolutivi post-deposizionali.

Le determinazioni sono state effettuate con l'utilizzo di due metodologie analitiche principali: la Spettrometria di Fluorescenza dei Raggi X e la Spettrofotometria di Assorbimento Atomico.

Contemporaneamente ai campioni provenienti dagli affioramenti emiliano-romagnoli sono stati analizzati quattro diversi materiali naturali, di composizione mineralogica simile, in corso di certificazione come Standard Internazionali di roccia gessosa, forniti dalla DOMTAR INC., Senneville, Québec, Canada.

[1] Istituto di Mineralogia e Petrologia, Università degli Studi.
[2] Istituto di Mineralogia e Petrologia, Università degli Studi e Gruppo Speleologico Emiliano C.A.I.

« GENESIS AND DEVELOPMENT OF "HYPOGEA BENDS", PECULIARS TO KARSTICS CAVITIES IN TRIASSIC EVAPORITE FORMATION »

MAURO CHIESI [1]

The Triassic evaporite formation, called of « Burano », is largeley exposed in the Reggio Emilia territory.

It consists of gypsum, anydrite, dolomite and, in the deeper part, of halite.

The sulphate-carbonates ratio is variable because of the strong tectonisation, but is globally valued 1:1.

These rocks are allochthonous and emerge as a diapir out of the Ligurid Unitis (clayey-chaotic thrust sheets).

They affect the Secchia river and his affluents evolution for a long way with strong solution phenomena.

The intense fracture, the lythological changeableness and the presence of insoluble components (dolomite) don't permit a direct control of the superficial morphology by speleogenesis.

Falls and slides prevail on solution, and karstic cavities evolve very quickly.

The cavities are formed by the sudden deviation of epigean rivers as they enter the evaporitic formation.

The waters rise on their natural river-beds after a variable hypogean way. These particular « hypogea bends » show, in their explorable parts, interestings peculiar aspects.

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(1) Gruppo Speleologico Paletnologico « G. Chierici » di Reggio Emilia.

« SPELEOTHEMS AND SECONDARY MINARALISATION OF "INGHIOTTITOIO DEI TRAMONTI", LARGEST EMILIAN CAVE IN TRIASSIC EVAPORITE »

MAURO CHIESI (1)

This superb cavity, discovered very recently, is the most remarkable between the caves of the Triassic evaporites in the high Secchia valley.

It originates from the swallowing of a little affluent, the « Rio dei Tramonti » brook.

The cave is explorable for 700 m and keeps for all its lenght a high slope, reaching a difference of level of −83 m.

A complex landslip has, untill now, not permitted to reach the resurgence which was already explorable for 99 m.

The subterranean hydric way is estimated around 900 m. In this paper we analyze the particular speleothems and some secondary mineralisation discovered.

Besides, we describe the hydrological hypogean schema of the hole out-cropping in which this cave opens.

It originates from the intercepting of two normal hypogean bends (deriving from two different rivers) caused by an evident tectonic accident which is ranged parallely with the major river trends.

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(1) Gruppo Speleologico Paletnologico « G. Chierici » di Reggio Emilia.

« HYDROGEOLOGY OF "CA' SCAPARRA" AND "CA' SPERANZA" KARSTIC SISTEMS - MESSINIAN GYPSUM FORMATION »

CARLA FERRARI e WILLIAM FORMELLA [1]

These karstic sistems are situated in a precise sector of the Messinian gypsum formation, exposed in the Reggio Emilia low Appennine.

We can observe a peculiar karst, affected by the particular geologic-structural situation: clayey interbeddings, and neo-tectonic.

These factors cause the evident incongruity between surface and ground water divides which affects the karstic morfology.

The present paper consists in a first arrangement about the developping modalities of hypogean hydrologic sistems under this situation.

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[1] Gruppo Speleologico Paletnologico « G. Chierici », di Reggio Emilia.

« HYDROGEOLOGY AND HYDROGEOCHEMISTRY OF THE TRIASSIC EVAPORITES IN THE UPPER SECCHIA VALLEY (Reggio Emilia, Italy) AND THE POIANO KARST SPRING »

P. FORTI [1], F. FRANCAVILLA [2], E. PRATA [3], E. RABBI [2], M. CHIESI [4]

The aim of the research was to analyze the chemical evolution of the Poiano spring in order to define the boundaries of its aquifer as well as its hydrodynamic.

To reach this goal two dye tracing experiments were carried out and during a year the physico-chemical parameters of the waters of the Poiano karst springs as well as those of the external rivers have been monthly recorded.

The same analyses have been done also inside the «Tanone della Gaggiolina» cave which is very close to the Poiano springs and whose hydrodynamic is perfectly known: these data were extremely usefull to interpret those of Poiano.

The acheived data allowed us to define with good accuracy the watershed boundaries for the Poiano springs as well as its hydrodynamic behaviour.

On the other hand it was not possible to state the origin of the salt (chlorine) water, which represents an important fraction of that

rising in the Poiano karst springs.

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« VEGETATION FEATURES IN THE TRIASSIC EVAPORITIC FORMATION OF THE UPPER SECCHIA VALLEY »

DARIA BERTOLANI MARCHETTI (1)

The vegetation of evaporites in the Upper Secchia Valley shows peculiar features related to properties of gypsy-calcareous substrate. It gives a great aridity and a strong insolation on an incoherent soil. There are conditions proper for apocratic plants. On the other hand, very different ecological conditions became where karst sink hole and hole appear, with cool and moist microclimate and shorter photoperiod.

Gypsy-calcareous walls and sheeps talus have given covert to *taxa* as *Artemisia lanata* and *Ononis rotundifolia,* very widely diffuse in tertiary Age. *Ostrya carpinifolia* (hophornbeam) is the most frequent arboreous species where the vegetation mantle is very solidly instated and it shows really as a forest.

More strictly related to the topic of this meeting are some vegetation features of the caves with sink holes. The very wide differences in comparison with the surrounding environment are phenological dischronism and the presence of plants belonging to higer vegetation belts.

Studies on lichens of hypogaeic cavities have never carried in this area; they are subject of another paper in this meeting.

(1) Istituto e Orto Botanico dell'Università di Modena.

« LICHENS OF HYPOGAEIC CAVITIES IN THE APENNINES OF REGGIO EMILIA (ITALY) »

PIER LUIGI NIMIS (1) and DANIELE DALLAI (2)

This study reports on the floristic variation of epiendolithic lichen

vegetation along a gradient of decreasing light intensity, from the mouth of hypogaeic cavities in gypsum rock downwards. Two sites have been selected for analysis: on N- exposed, the other S- exposed. They are both located in the Valle del Rio di Sologno, in the Apennines of Reggio E. The results may be briefly summarized as follows:

In the N- exposed cavity (the most humid) superficial alteration of the gyps is to strong to allow the growth of a rich lichen vegetation. Only two leprose species, specialized to extremely shady sites are present: *Caloplaca chrysodeta* and *Lepraria incana.* The epilithic vegetation is mostly composed by ombrophytic organisms (frequent water dropping), chiefly hepatics and algae. The S-exposed stand is much more species rich: from the mouth of the cavity to 6 m depth 31 lichen species have been recorded. The variation of lichen vegetation with increasing depth (up to 6 m) is characterized by a sharp decrease of xero- and photophytic lichens, and by a parallel decrease in species diversity; With increasing depth lichens are substituted first by bryophytes (mostly hepatics) and then by green (Trentehpolia) and blue-green algae.

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(1) Dipartimento di Biologia Università di Trieste.
(2) Istituto di Botanica Università di Modena.

IL CARSISMO NEI GESSI MESSINIANI DELL'EMILIA-ROMAGNA
MESSINIAN GYPSUM KARST IN THE EMILIA-ROMAGNA REGION

NOTE PRELIMINARI SULL'ABISSO G. MORNIG (119 E/RA) E SULL'IDROLOGIA CARSICA DEI «GESSI DI RONTANA E CASTELNUOVO» NELLA VENA DEL GESSO ROMAGNOLA

L. BENTINI, G.P. COSTA, R. EVILIO [1]

Dopo una premessa sulle conoscenze dell'area carsica in esame, con riferimento anche al leggendario Buco dei Morti, ai tempi in cui vi condusse le prime esplorazioni (1934-35) lo speleologo triestino Giovanni Martini Mornig, vengono forniti i nuovi dati recentemente acquisiti sulla circolazione superficiale ed ipogea delle acque che, nascendo a q. 368 dalla Grotta risorgente di Ca' Carnè (394 E/RA), confluiscono nel Torrente Sintria.

Tali acque scorrono in superficie su terreni della « Formazione Marnoso-arenacea » fino ad una cavità assorbente, l'Inghiottitoio a NE di Ca' Piantè (458 E/RA), che si apre a q. 285 e drenate fino all'Abisso G. Mornig (119 E/RA), che è risultato essere il collettore anche delle acque di un più ampio bacino carsico i cui punti idrovori sono però attualmente ignoti.

Prove colorimetriche hanno confermato che le acque canalizzate pervengono alla Grotta Risorgente del Rio Cavinale (457 E/RA) che si sviluppa sotto la rupe di Castelnuovo, tornando a giorno alla quota di m 143.

Il complesso Inghiottitoio — Abisso Mornig — Risorgente, sebbene non completamente percorribile, con un dislivello di 142 m risulta essere il più profondo attualmente noto della Regione.

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[1] Gruppo Speleologico Faentino.

« HYDROGEOLOGY AND HYDROGEOCHEMISTRY OF THE "RIO STELLA - RIO BASINO" KARST SYSTEM (Riolo Terme, Italy) »

F. FRANCAVILLA [2], P. FORTI [2], E. PRATA [3], E. RABBI [1]

The « Rio Stella - Rio Basino » karst system is one of the most important cave of the « Vena del Gesso Romagnolo » Messian gypsum outcrop.

In the present paper the result of the chemico-physical analyses carried out monthly during the 1983-1984 over the waters crossing the system are reported.

Moreover the geological structure of the area is discussed with respect to the genesis and the genesis and the development of the karst system.

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[1] Dipartimento di Geografia, Università di Bologna.
[2] Istituto Italiano in Speleologia.
[3] Istituto di Geologia, Università di Bologna.

LATEST MESSINIAN VERTEBRATE FAUNA PRESERVED IN A PALAEOKARST - NEPTUNIAN DYKE SETTING (Brisighella, Northern Apennines)

COSTA G. [1], COLALONGO M.L. [2], MARABINI S. [2], TORRE D. [3], DE GIULI C. [3], VAI G.B. [2]

A rich, diverse and good preserved, though fragmentary, continental vertebrate fauna was found within the uppermost Colombacci Fm. of terminal Messinian age. The bones, originally preserved within alluvial plain muds, were first disarticulated and enriched by means of torrential streams and subsequently redeposited in a brackish environment and eventually concentrated further and stored within late Messinian neptunian dyke fillings.

The sedimentary dykes cutting across the folded Gessoso-solfifera Fm. trend about N 20° E according to the main regional faulting system. The polyphase dyke filling shows prevailing injection structures controlled by strike-slip movement of the enclosing evaporites; gravitative structures are also found. The strike-slip dyke-filling phase is predated by a minor karst-hole development along the same joint system. This

palaeo-karst process took place during the intra-Messinian folding and emersion phase.

The local stratigraphic sequence is made up by: 1) Gessoso-solfifera Fm. (lower Messinian) unconformably overlain by 2) a very thin (0 to 1.5 m) Colombacci Fm. (uppermost Messinian) and 3) light-grey marly clays (lower-most Pliocene, *Spheroidinellopsis* Zone).

The fauna consists at least of *Hipparion,* large size *Dicerorhinus, Prolagus,* hart or gazelle, small size rodents and mammals, birds. The mudstone containing the bones yields *Dreissensia, Melanopsis, Melanoides Limnocardium* and *Cyprideis* of uppermost Messinian age; it is posdated by the lowermost *(Spheroidinellopsis)* Pliocene.

The new vertebrate fauna is expected to provide critical insights to the correlation between the continental (Paratethys), marine (Mediterranean) and oceanic stratigraphic scales.

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(3) Dipartimento di Scienze della Terra, V. La Pira 4, I-50100 Firenze.

« PRELIMINAR OBSERVATION ON THE INTERACTION BETWEEN TECTONIC STRUCTURE AND KARST CAVITIES GENESIS »

MARIA LUISA GARBERI (1) GIOVANNI BELVEDERI (1)

In this work the authors have drawn the lines observed in the karst area of Farneto (San Lazzaro Bologna Italy) through aerial photographic interpretation.

The interpretation, from the speleogenetic point of view of such lines has been made throught the comparative study of microfractures noticed inside the main karst cavities which can be found in the area under examination, and the direction of the relative developments of the branches of the above cavities.

This comparative analysis has show that the lines observed in the aerial photographs coincide substantially with the real fractures which have a considerable importance for the local speleogenesis.

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(1) Gruppo Speleologico Bolognese, Unione Speleologica Bolognese.

« OSSERVAZIONI SULLA MORFOLOGIA DEI GRANDI CANALI DI VOLTA PRESENTI NEL PIANO SUPERIORE DELLA GROTTA DELLA SPIPOLA (Bologna, Italia) »

MASSIMO BRINI [1], PAOLO GRIMANDI [1]

Fra le numerose morfologie che caratterizzano la Grotta della Spipola (5/ER/BO), spiccano per importanza e varietà di forme i grandi canali di volta, presenti in molte parti della cavità, ma con particolare evidenza nelle gallerie che precedono la così detta «Dolina interna», a 350 metri dall'ingresso.

In questo tronco della grotta la volta, intatta, conserva una miriade di canalicoli di sviluppo e dimensioni estremamente diversificate e complesse.

Il rilevamento di dettaglio dell'intero reticolo costituito dai canali di volta ha offerto lo spunto per un tentativo di interpretazione dei fenomeni osservati, la cui genesi e la cui evoluzione hanno svolto un ruolo indubbiamente determinante nella formazione dell'intero Complesso Spipola-Acquafredda.

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[1] Gruppo Speleologico Bolognese, Unione Speologica Bolognese, Società Speleologica Italiana.

« RECENTI ESPLORAZIONI NEL COMPLESSO SPIPOLA-ACQUAFREDDA (Bologna, Italia) »

MASSIMO BRINI, MAURIZIO FABBRI, PIERGIORGIO FRABETTI, PAOLO GRIMANDI [1]

La più recente campagna di ricerche esplorative condotta da G.S.B. e U.S.B. nel settore mediano e terminale del Complesso Spipola-Acqua Fredda si è concentrata nella porzione più tettonizzata di questa parte del Sistema: il Salone G. Giordani della Spippola.

Qui, attraverso alcuni passaggi fra i grandi massi della frana che occupa il lato Ovest del Salone, si è penetrati in una serie di brevi gallerie, parzialmente intasate da sedimenti, che costituiscono la normale prosecuzione della Grotta, a valle della Sala della Dolina Interna.

Il rilevamento di questi tronchi di cavità, che devono la loro integrità al fatto — peraltro inconsueto — di essere situati ad Ovest della faglia N-NO, che determina e delimita lo sviluppo della Grotta della Spipola, ha consentito quindi di formulare più documentate ipotesi sull'evolu-

zione della Grotta, e di verificare al contempo l'esattezza degli elaborati topografici, mediante il fortuito rinvenimento, all'interno della Grotta, di un tubo di carotaggio minerario, in seguito facilmente ubicato e reperito all'esterno.

È stato inoltre possibile, con la risalita di un'alta parete, raggiungere la parte più elevata della grotta, a brevissima distanza dall'esterno, ad una quota di molti metri superiore all'ingresso.

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(1) Gruppo Speleologico Bolognese, Unione Speleologica Bolognese, Società Speleologica Italiana.

« GENETICAL ANALYSES OF NATURAL CAVITIES IN THE MESSINIAN EVAPORITES OF THE AREA OF BOLOGNA (ITALY) »

F. FINOTELLI (1), E. GIRALDI (1), G.A. PINI (2)

Starting from detailed analysis carried out in some of the most important caves of the Croara Area (Bologna, Italy) this paper presents a general interpretation about the genesis and evolution of the Spipola-Acqua Fredda karst system.

This work started with stratigrafic and structural observation followed by morfological analysis of both surface and deep karst structures. This study allows to demonstrate that in these particular regions the knowledge of deep karst is of fondamental importance in order to solve stratigrafical and structural forms of the whole karst outcrops.

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(1) Gruppo Speleologico Bolognese, Unione Speleologia Bolognese.
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« DIFFICULTIES AND THECNIQUES OF PROGRESSION IN THE EMILIA-ROMAGNA DISTRICT MESSINIAN GYPSUM (Italy) »

PAOLO NANETTI (1)

Difficulties connected to the exploration of the Messinian gypsum cavities in Emilia-Romagna derive directly from two elements: of both mechanical qualities and alternation of different types of rocks among which: marls, characterizing karst landscape in surface and in depth. On one hand the particularities of gypsum (crystalline structure, impurity, hardness) impose particular cautions in using pitons and limit

the choice to few types of them; on the other hand the presence of marl beds make difficult advancing by usual thecniques and equipment. Incoming torrents attack those marl beds and carry them in large liquid deposits at the base of passages and squeezes, and sometimes along the potholes' walls.

Individual and collective equipments used by Bolognese Speleological Groups during the most demanding explorations are, therefore, here briefly reviewed. Difficulties coming from the mentioned environmental conditions, in case of rescrue in serious accidents happened in flooded areas, are illustrated as well.

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(1) Gruppo Speleologico Bolognese, Unione Speleologica Bolognese, Società Speleologica Italiana.

« THE SPIPOLA CAVE TOURISTIZATION INSIDE THE GESSI BOLOGNESI REGIONAL PARK (Bologna - Italy) »

PAOLO FORTI (1), PAOLO GRIMANDI (2)

The Spipola show cave project, prepared in 1981-82 by the Caving Clubs of Bologna, is now under practical realization with the financial support of local governments, which cooperate to improve natural parks in the Emilia-Romagna region.

Particular care to conservation problems has been taken in the show cave project, so that only small morphological modifications and no fixed lights inside the cave have to be realized.

The role which the Gessi Bolognesi natural park will play in the recreative, educational and research fields is also shortly pointed out.

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(1) Istituto Italiano di Speleologia, Unione Speleologica Bolognese, Gruppo Speleologico Bolognese.

(2) Gruppo Speleologico Bolognese, Unione Speleologica Bolognese, Società Speleologica Italiana.

« PROBLEMS OF ENVIRONMENTAL PRESERVATION IN THE EMILIA-ROMAGNA DISTRICT (MESSINIAN GYPSUM (ITALY) »

PAOLO GRIMANDI (1)

The miocene gypsa outcrops in Emilia-Romagna district have their

largest expansion in Bolognese area expanding between Savena and Idice torrents and in the vast territory of the neighbouring Romagna between Santerno and Lamone torrents.

Being also recognized for remarkable reasons of naturalistic and cultural interest, those areas, which comprise superficial and deep imposing karst phenomena, have been, for 20 years, under many generical and inconclusive measures of environmental exploitation and landscape protection proposed by about ten different projects of two Regional Parks: the Bolognese Gypsum Park, and the Park of Romagna Gypsum Vein.

Actually, nothing has been done: the mining activities and the political influence of building societies and hunter associations, interfere, and by now actually have prevented, the realization of those natural parks.

Lacking the longed for legislative measures, environmental degradation rapidly increases: woods are eaten up by roads and by building-up areas, waters pollution and abusive urban trash spread in the whole karst area and the mining activity itself develops and expands, destroying a speleological and naturalistic patrimony, unique in Europe.

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(1) Gruppo Speleologico Bolognese, Unione Speleologica Bolognese, Società Speleologica Italiana.

IL CARSISMO NELLE EVAPORITI ITALIANE
EVAPORITE KARST IN ITALY

« LE ATTUALI CONOSCENZE SUL CARSISMO NELLE AREE GESSOSE DELLA SICILIA »

ABBATE ROSARIO [1], MARINO ANTONIO [2]

I gessi della Serie Gessoso-Solfifera hanno in Sicilia un vasto sviluppo areale e spesso possono raggiungere spessori di considerevole potenza.

Nonostante il carsismo nei gessi dell'isola sia stato segnalato nello scorso secolo, ben poco si sa del suo reale sviluppo.

Il carsismo superficiale è caratterizzato da ampie doline, più o meno regolari, che presentano quasi sempre un inghiottitoio o almeno un punto idrovoro, ubicato generalmente al contatto gesso-argilla.

Le cavità sono quasi sempre attraversate da corsi d'acqua, che di solito emergono da risorgenze. Le grotte sino adesso conosciute, poche rispetto alla vastità del fenomeno, hanno un andamento sub-orizzontale o verticale e a volte sono caratterizzate da ampi ambienti e da morfologie freatiche. Attualmente le aree esplorate in cui è segnalata la presenza di forme carsiche sono i territori di Campofranco, Santa Elisabetta, S. Angelo Muxaro, Santa Ninfa, Vita e Ciminna.

Dall'indagine eseguita si è notato che il potenziale carsico è imponente, per cui si può ipotizzare che un numero notevole di cavità ancora sconosciute siano presenti nei terreni evaporitici dell'isola.

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[1] Gruppo Speleologico C.A.I., Lovere.
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« UPPER MYOCENE GYPSUM KARST NEAR ST. VALENTINO (Abruzzo, Italy) »

S. AGOSTINI [1, 2], M. FASCIANI [2], M.A. ROSSI [1, 2]

In the tectonic depression between the M. Morrone and the M. Maiella, in the Abruzzi Apennines, outcrop heteropic formations (calcarenites, marls and sandstones of turbiditic facies) that include gypsum lenses and gypsum arenites. Gypsum and limestone formations are interested by fossil and recent karst processes. The evolution of this process is controlled by a lifting and by the re-establishing of two tectonic lineaments. The karst process is also related with the river Orta paleogeographical evolution pattern. Alluvional units, paleosoils with prehistoric industries consent to reconstruct the morfological evolution cronology.

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[2] Gruppo Speleologico Ipogeo, Scafa (Pescara).

« SPELEOTHEMS AND CAVE MINERALS OF THE GYPSUM KARST OF THE EMILIA-ROMAGNA REGION, ITALY »

PAOLO FORTI [1]

In the past only few works have been done to study the chemical deposits inside the gypsum caves of our region and the reason was that all the people thought that in such caves only very few and small speleothems can be found and no minerals at all.

Despite this general opinion the studies carried out mainly in these last years allowed not only to find peculiar speleothems but also several rare cave minerals, two of which completely new for the cave environment in all the world.

In the present paper after a short historical excursus on the researches carried out in the mineralogical field inside the cave of the Emilia-Romagna region, the most important spleothems are described and then a full list of the cave minerals till now discovered is given.

[1] Istituto Italiano di Speleologia.

« RELAZIONI ESISTENTI TRA TERREMOTI STORICI E DEVIAZIONI NEGLI ASSI DELLE STALAGMITI: DATI PRELIMINARI DALLE GROTTE DI BOLOGNA (ITALIA) »

P. FORTI [1] and D. POSTPISCHL [2]

L'analisi di due stalagmiti prelevate in grotte differenti dei Gessi Bolognesi ha permesso di evidenziare la notevole correlazione esistente tra le deviazioni negli assi di accrescimento di ambedue le stalagmiti. Inoltre tali deviazioni possono esser cronologicamente ben riferite al catalogo dei terremoti storici per l'area di Bologna.

A conferma della attendibilità dell'ipotesi avanzate, l'aumento medio annuo che si ricava dalle due stalagmiti è abbastanza simile a quello osservato sperimentalmente all'interno del Laboratorio Grotta Novella.

I dati ottenuti, comunque, dovranno necessariamente essere controllati attraverso datazioni radiomentriche.

[1] Istituto Italiano di Speleologia, Unione Speleologica Bolognese, Gruppo Speleologico, Bolognese.
[2] Unione Speleologica Bolognese, Gruppo Speleologico Bolognese.

GYPSUM SOLUTION INTO ALLUVIAL DEPOSITS

G.B. CARULLI [1], F. CUCCHI [1] F. GIORGETTI [1]

The stratigraphic series of North-Eastern Alps are characterized by thick Permian and Carnian evaporitic horizons that can give frequently rise, expecially in the quaternary cover, to alluvial and collapse dolines. These phenomena are more or less connected with the dissolution of strewn gypsum.

Hydrogeological, geophysical and geotecnical studies carried out in these areas allow to express hypothesis on the origin and evolution of the phenomenon, to locate areas with largest risk and to indicate the best way to intervene.

The preliminary factors that seems to be acquired in the field are structural and lithological characteristics of the formations and its degree of karts evolution, thickness, lithology, stratigraphy, grain size distribution and soil mechanics of the cover, hydrogeological parameters of the water table and last anthrophical interventions.

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IL CARSISMO NELLE EVAPORITI DEL MONDO
EVAPORITE KARST IN THE WORLD

« CURIEUSE DESTINEE D'UN MOT: LE PARAKARST »

J. CHOPPY

RESUME - Les avatars du mot parakarst témoignent de l'évolution des idées relatives à des morphologies rappelant celle du karst dans des roches peu ou pas carbonatées.

ABSTRACT - The mishaps of the word parakarst testify the development of notions relating to morphological aspects reminding theses of karst in few or not carbonate rocks.

« KARSTS DES EVAPORITES DE L'ORANAIS (Algérie) »

J. CHOPPY, Y. CALLOT

RESUME - En Algérie, les dépôts évaporitiques sont d'âge triasique, miocène et actuel. Dans la partie Ouest de l'Algérie, des grottes se trouvent dans le Miocène. Les affleurements du Trias sont d'origine diapirique, et déterminent des phénomènes karstique variés.

ABSTRACT - In Algeria, the evaporitic deposits are triasic, miocene and actual period. In the west part of Algeria, exist caves in miocene. The outcrops of trias are diapiric origin, and control various karst phenomena.

« SOME REMARKS ON PHASE EQUILIBRIA OF EVAPORITES AND OTHER KARSTIFIABLE ROCKS »

ARRIGO A. CIGNA [1]

The weel-known effect of mixture corrosion in limestone described by Boegli is a common feature for many non-linear processes.

The process of dissolution of gypsum can be enhanced by the effect of mixture corrosion by waters at different temperatures. This fact can play a role in the presence of thermal waters.

On the other hand, halite has a nearly-linear curve of dissolution in funtion of water temperature and it is not affected by mixture corrosion. Due to the curve concavity an effect of mixture deposition may occur.

The influence of common ions and foreign substances in limestone is also discussed with reference to the classification of karstic phenomena.

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(1) Società Speleologica Italiana.

« GENESIS AND DEVELOPMENT HISTORY OF THE LARGE GYPSUM CAVES IN THE WESTERN UKRAINE »

VICTOR N. DUBLJANSKY, ALEXANDER B. KLIMCHOUK (1)

There are many caves in the Miocenic gypsum in the Podolsko-Bucovinsky karst region, including of well-known largest labyrinth cave systems such as Optimisticheskaya (153 km), Ozernaya (105,3 km), Zolooshka (80 km), Kristalnaya (22 km), Mlynky (18 km) and others. The modern geological and hydrogeological conditions of their occurence are given in the another paper (A. Klimchouk, V. Andrejchouk).

Genesis and evolution of the main caves of this region had been examined in the numerous works where can be found the different and contradictory conceptions. These problems are very important from both scientific and applied points of view. During the last years the extensive researches on these problems have been conducted. The main trends of them are following:

1. *Geological and geomorphological investigations* had been aimed to both cognition of the moderne conditions in detail and revealing of evolution of natural situations of the past.

2. *Speleomorphogenetical investigations* consist of speleostructural and speleosculptural analysis. The first of them includes investigation of cave systems structure (statistical study of different parameters of passages networks and geological and paleohydrogeological interpretation of these data). The second method consist of study of meso- and microforms and their interrelations so that to reveal a succession of formation and hydrodinamical conditions of development of different cave system elements.

3. *Speleosedimentological investigations* consist in detailed study of cave deposits, especially of fluvio-clastic ones as it is most informatively for paleoreconstructions. Study of modes occurence, granulometric and mineral analysis, paleomagnetic and palynologic examinations were conducted.

The conjugate analysis of cave systems development history on the background of general geological and geomorphological evolution of the territory have been carried out using the data from the all above mentioned trends.

The investigations which were conducted allows to reveal that the large cave systems consist of heterogenous and heteroage elements. The most ancient cavities had formed in the last Miocene. During the Sarmatic marine regression these cavities and fissuries in gypsum were filled by carbonaceous and clayey deposits. In the Last Sarmatian continental conditions have been established on the all territory, but the gypsum strata was covered by thick nonkarstifiable deposits. During the Last Pliocene - Early Pleistocene origin and downcutting of river valleys took place and cavities were developed below of them in the gypsum strata, under phreatic conditions. Longitudinal undervalley and transversal intervalley underground water circulations took place at that time.

In the Middle Pleistocene the gypsum strata in the first and second zones was stripped by main valleys and a vadose stage of cave development was begining. The forming of blind valleys and engulf sink holes in ravine thalwegs was begining too on interfluve massives. Small vadose caves and vadose mesoforms in morphology of some parts of phreatic systems had been formed by action of streams in gypsum. Continous flooding of lower part of gypsum strata remain in the central areas of the wide interfluve massives.

Vertical channels which form by destending point filtration from above lied rocks are being in superposition to cavities of phreatic systems.

Gypsum cavities in the third zone are under phreatic conditions now and find itself under vadose conditions in the special cases as result of artificial fall of water level.

Local tectonic and hydrogeological peculiarities determine important individual features of evolution, structure and morphology of the separate cave systems and even separate areas of the one cave system.

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« CHARACTERIZATION OF GYPSUM KARST IN SPAIN. ITS RELATIONSHIP WITH STRATIGRAPHIC AND STRUCTURAL CONDITIONS »

DURAN VALSERO, J. J. (1) BURILLO PANIVINO, F. J. (2)

The development of spanish gypsum karsts occur in evaporitic-detritic mixed formations, which may be crowded together in three groups:

— Triassic formations (keuper facies)
— Paleogene formations
— Neogene formations

Their lithostratigraphic and structural features are different:

Triassic gypsum are found mixed with other lithologies (sandstone, claystone, carbonated and subvolcanic rocks) due to the high deformation level and to halokinesis and/or diapirism processes.

However, in paleogene and neogene karstic formations, gypsum is clearly separated, oftenly layered together with clays, and appearing pure gypsum layers with more than 50 metres thickness. Faults and folds controll the geometrical features of the first group, while only tectonic fracturation is important in the second .

Refering to geomorphological and hydrogeological aspects, neogene and paleogene gypsum karsts are clearly conditioned by fractures, along which acuifer circulation flow; in triassic karsts this condition is not evident.

Superficial forms have a large development in triassic karsts, being present in neogene karsts where underground forms are more importants.

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« TRIASSIC GYPSUM KARST OF THE "LOMA DEL YEAR" (Archidona, Malaga; Southern Spain) »

DURAN VALSERO, J. J. (1) BURILLO PANIVINO, F. J. (2)

The *Loma del Yesar* is a karstic system installed on triassic materials of keuper facies (clays an gypsum, mainly). Hydrologically, this system is formed by a catchment area 8,5 km^2 of surface) with great number of closed depressions (3 dolines per square kilometre) and whose visible discharge are two main springs. One of this is a penetrable cave about 300 metres: The *Cueva del Agua.*

With the available data, the water balance, is:

Precipitation (5,90 Hm^3) = Real Evapotranspiration (3,08 Hm^3) + + Springs discarge (1,00 Hm^3) + Discharge to other aquifer (1,01 Hm^3).

About the hydrochemical aspects, the karst water is clearly calcium-sulphate water, with a total content in salts around 2.000 mgr/l.

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« GEOLOGICAL AND HYDROGEOLOGICAL CONDITIONS OF GYPSUM KARST DEVELOPMENT IN THE WESTERN UKRAINE »

ALEXANDER B. KLIMCHOUK (1), VJACHESLAV N. ANDREJCHOUK (1)

Karst phenomena in the Neogenic gypsum rocks are spread widly in the Western districts of the Ukraine. Gypsum karst of the Western Ukraine is well-known owing to world largest labyrint caves.

The gypsum strata with power 10-40 m is lain on the Lower Noegenic limestones and sandstones. Marine and terrigenous rocks of the Cretareous, Devonian and Silurian are underlying. The gypsum is overlaped by limestones, marls, loams and clays of the Upper Badenian and Sarmatian.

There are essential differences of geological, tectonic, geomorphological and hydrogeological conditions in the territory of the gypsum spread. The important peculiarities of karst development history, karst morphology, modern activity are conditioned by these differences.

The gypsum karst region are on the joint of two large tectonic structures: the Eastern European platform and the Pre-Carpathian foredeep. A block structure is the most important tectonic peculiarity.

Three typical situations of karst development in the region of joint platform and foredeep have been distinguished on a basis of complex geological, tectonic, geomorphological and hydrogeological conditions. Corresponding zones stretch out in the direction NW-SE and replace each other from NE to SW.

1. There are block mosaic with an amplitude of diplacement 10-30 m between adjacent blocks in the first zone. The main rivers and their tributaries downcut a geological section much below the gypsum strata. The gypsum strata is drained on near-valley parts and is partially flooded in central parts of interfluve massives. Well-known large labyrinth caves

such as Optimisticheskaya (153 km), Ozernaya (105,3 km), Kristalnaya (22 km), Mlynky (18 km) and others are in this situation.

2. In the second zone blocks are plunged by steps to South-West with an amplitude of displacement of adjacent blocks 30-50 m. Gypsum strata is stripped by fluvial downcutting only partially and surface streams intake occurs. Gypsum strata is flooded partially and subhorisontal flowing of streams occurs into strata. There are many small caves of a linear type with vadose morphology in this zone.

3. There are the same situation with block structure in the third zone, but then, to South-West, gypsum strata falls to the foredeep along the large faults. Gypsum strata is not stripped by fluvial downcutting and it is flooded completely. There are large phreatic labyrinth caves in this zone. In special cases they become accessible for speleological exploration owing to change of the conditions from phreatic to vadose as results of pumping out in the time of mining (Zolooshka cave, more than 80 km long).

The history of karst development, morphology of surface and underground karst forms, activity of modern karst processes are original in every zone and are considered in the paper.

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« KARST AND CAVES IN GYPSUM ON THE USSR TERRITORY »

ALEXANDER B. KLIMCHOUK ([1])

Evaporite formations on the USSR territory occupy about 5 mln-km^2. Gypsum and anhydrite rocks prevail ofthen in their composition. Gypsum deposits are age from the Last Proterozoic till now.

Gypsum rocks are widely spreaded in platforms and foredeeps and they occur in intermountain areas and marginal parts of folded systems. There are three large regions of gypsum rocks spreading on the USSR territory such as: East European, East Siberian and Central Asiatic. The following two main situations of gypsum karst can be distinguished according to general geological and hydrogeological conditions: 1) old karst, which is situated on a large depth from surface, in zone of difficult water movement. Burial and filled karst forms prevail in this situation; 2) old-rejuveneted and modern karst of gypsum rocks which are situated not far from surface, in zone of active water movement.

Karst landforms and gaping cavities are characteristic for this karst.

The first situation prevail in the East Siberian region and second one is widely spreaded in the East European and The Central Asiatic regions.

Wide spread of active gypsum karst on the large territories of the European part of the USSR make many practical problems in the time of building, mining, water supply, etc.

About 60 karst caves in gypsum which have length more than 500 m are known on the USSR. Their total length is 511,5 km. Most of large gypsum caves are situated in the East European region (Podolsko-Bucovinsky, Valdaj-Kulojsky, Pred-Ural'je). They occur in the Central Asiatic region too.

Distrubition of gypsum caves in the East European and Central Asiatic regions and their characteristics has been given in the paper.

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« MORPHOGENESIS OF THE BIR AL GHANAM GYPSUM KARST/LIBYA »

Dr. ATTILA KÓSA

Erosion following the uplift of the Jabal Nefusa/North Tripolitania/ exposed thick beds of gypsum in the escarpment. Karstification was probably low grade until denudation processes developed inselbergs from promontories and the surface topography of the formation changed to gentler slopes and plateaus.

The Jurassic Bir al Ghanam Formation consists of two gypsum members separated by an argillacious-dolomitic impervious member - thus in the course of denudation karst develops at an upper and at a lower level in slightly different character. Typical features of the surface are conical hills, similar in character to tropical «kegel» karst.

Two types of caves car be found in the Bir al Ghanam area, one type in the thick upper and lower gysum beds, the other right under the dolomite plateaus of the member in the middle. The features of the caves show a very direct relation to stratigraphy and tectonics as they follow a general direction of the dip of the gypsum beds and individual passages show a clear pattern of joints. Profiles of the passages also show this double character plus the effects of intercalated thin impurities.

« THE INFLUENCE OF EVAPORITE BEDS ON THE HYDROGEOCHEMISTRY AND THEIR VERTICAL ZONALITY: A CASE HISTORY FROM POLAND »

EWA LISZKOWSKA

The problem formulated in the title is a well known ones. However, this problem is analysed mainly in qualitative form. The paper present for a given area an attempt to quantitative evaluation of the significance of dissolution of evaporites (gypsum) on the hydrogeochemistry and vertical hydrogeochemical zonality of groundwaters in space and time. The method used is based on the solution of the mass transfer equation and experimental evaluation of the hydrogeochemical parameters.

« MECHANISMS AND KINEMATICS OF SINKHOLES DEVELOPMENT OF THE GYPSUM KARST IN POLAND »

JERZY LISZKOWSKI

It is generally accepted that there exist three main genetic types of small closed karst depressions: (i) solution-; (ii) collapse- and (iii) drift or suffosion sinkholes (dolines). Based on extensive field studies it seems that the whole problem of sinkhole development — at least for gypsum karst — was up today oversimplified and is in reality much more complex than prior suggested. At least three other mechanisms of sinkhole formation were recognized, each of specific kinematic parameters. The paper present a classification of sinkholes according to their genesis and kinematics, clarify the different mechanisms of subsidence and the main geoenvironmental factors controlling the kinematics of the vertical mass movements related to them and present typical strain-time curves for every of the sinkhole types distinguished.

« ENGINEERING GEOLOGICAL INVESTIGATIONS OF GYPSUM KARST »

I.A. PECHORKIN [1]

Engineering geological investigations of karst deposits always encounter difficulty, in the areas of sulphate rocks in particular. Under such conditions it is highly necessary to consider natural development of karst process taking into account historical geological analysis. Then

the interaction of the object under construction with geological surroundings is studied carefully: the influence of the surroundings on the construction and vice versa, first and foremost, on karst process development. Creation of reservoirs, construction of large industrial and civil objects make karst process more active. In this connection the forecast of karst process development and estimation of territory stability are found to be necessary. Thus when carrying out engineering geological investigations in the areas of gypsum karst the underground water hydrochemistry and rock solubility should be studied in details.

Special attention should be paid to the dynamics of karst process quickly changed under the influence of engineering construction. The highest form of engineering geological art is to govern karst process development, so special measures in governing the process are considered to be necessary. The measures are in two directions. The first is the passive protection. The second is the active impact on the process.

The proposed program provides safe exploitatin of engineering constructions in the areas of gypsum karst.

([1]) Perm State University, USSR.

« ON GYPSUM AND ANHYDRITE DISTRIBUTION IN NEAR-SURFACE ZONES OF SULPHATE MASSIFS »

A.I. PECHORKIN ([1])

Gypsum and anhydrite distribution in aeration and intensive water-exchange zone is conditioned to a certain extent by geostructural peculiarities of the territory under study represented by the zones with various degree of tectonic jointing and stressed state of the massif, that prevents or contributes to development of the process of hydration. Water circulating through the massif is more saturated with calcium sulphate then that in highly jointed rocks with higher degree of stressed state of the massif and in this results more saturated with anhydrite which as it well-known is midely spread in slightly jointed rocks with lesser degree of stressed state of rock formed by lesser deformed crystals. It results in gypsum precipitation from solution in lesser jointed and stressed zones. Supersaturated solutions make favourable conditions for diffusional hydration. Gypsum content in lesser jointed

zones is higher than that of highly jointed. The depth of gypsum occurrance is specific for every massif and does not depend on gravitational loading which values are lesser than that of tectonic one and are determined by changes of structure and texture peculiarities of anhydrite rock thickness. It is known that in some areas of cross-section conditions for hydration are found to be favourable, in other-unfavourable.

When studying massifs formed by soluble rocks conclusions about mineral composition of rock should not be based on the results of investigation of individual samples. In central parts of inter-fractured blocks gypsum content is 80-100%. Correct system of sampling in all parts of inter-fracturing blocks makes it possible to receive true information about mineral and lithological composition of rocks.

([1]) Perm State University, USSR.

« INTERCONNECTION BETWEEN LONG SULPHATE KARST CAVE SYSTEMS AND TECTONIC JOINTING DISTRIBUTION »

A.I. PECHORKIN ([1])

Interconnection between karstification and tectonic jointing distribution is one of the most important problems of geological investigations of the massifs formed by soluble rocks. Our study shows that tectonic jointing plays the main role in distribution of karstification. In the course of investigations carried out at the Chair of Engineering Geology (Perm State University) under the leadership of the authour make it possible to develop methods of tectonic jointing mapping for karstological purposes. These methods include measuring of joint bedding elements and the distance between the joints, compiling large-scale maps (plans) of tectonic jointing distribution and calculation of the common length and the quantity of joints per square unit of the massif surface. As a result the isoline maps of all the above-mentioned parameters have been obtained.

The mapping of tectonic jointing of the block-type structures in the areas of Zolushka and Bukovinka caves (Predkarpatje) shows that all channels and chambers of the caves are associated with the zones of thickening of tectonic joints. It was indicated that the isoline maps of the common length of the channels in Zolushka Cave are identical to those of the common length of tectonic joints. It gives grounds to proove the leading role of tectonic jointing in formation of subsurface karstification.

« SALT KARST RELATED TO IRON-BEARING PIPES »

A.G. PHILIPPOV, G.S. PHON-DER-PHLAHS, V.I. NICULIN

Salt karst is widely developed in near pipe area of orebearing pipes of Angara iron-ore province of Siberian platform. It was developed in flat-lying, salt-bearing low Cambrian deposits at depths 1.0-2.5 km due to the formation of iron-ore deposits in low Triassic time. Evacuation of dissolved rock salt proceeded through pipes and zones of near pipe jointing. At the same time, but in lesser degree, hydrothermas were carrying out sulphates and carbonates. Unloading of metalliferous brine and salt hydrothermas was conditioned the hydrothermal transformations, skarning of volcanogenic rocks that infilling pipes. The karts was developed in thicknesses reduction of salt-bearing deposits, accompanied by the subsidence of super-salt strata with formation of basin-shape structures of subsidence. For structures of solution subsidence are characteristic oval in plan and sincline-shaped form in the cross-section. Their size depends on the scale of ore bodies and achieves 4-7 km in diameter and 0,3 km in depth. The formation of basin are accompanied by process of solution subsidence of stratified sedimentary formation. Subsidence of super salt strata is passed ahead of regional denudational section that has led to the preservation of young deposit relics on the background of more ancient deposits in the basins.

« DISTRIBUTION AND PRACTICAL ASPECTS OF THE EVAPORITE KARST IN POLAND »

M. PULINA, J. LISZKOWSKI

Evaporite karst of Poland include both gypsum and/or anhydrite and halite karst. Both mineralogical types of evaporite karst are in Poland — fortunatelly — of limited extension only, the last occuring exceptionally. Gypsum karst is known mainly from the northern border of the Neogene Carpathian Foredeep between Wislica, Busko and Staszów. The gypsum bed itself is of Middle Badenian Wielician age and distributed over the whole area of the molasse basin from Czechoslovakia to the Ukrainian SSR up to Rumania. Nacked and covered gypsum karst occur, the last being more developed, including allmost all topographic and hydrologic effects of karst areas. Local occurences of halite karst

phenomena are known from the region of Bochnia and Wieliczka, may be man-induced.

No Serious engineering problems related to these types of karst occur in Poland, although damages of individual groups of buildings and construction works were registered. Severe water supply problems are the main ones related to evaporite karst. Moreover, the gypsum karst in Poland is of great economic interest, hence native sulphur deposits are spatially and may be genetically related to them.

Small gypsum karst complexes are protected landscape areas, state natural reserves or protected natural, geologic-geomorphologic monuments.

« GYPSUM KARST AND SALT KARST OF THE UNITED STATES »

J.F. QUINLAN [1], A.R. SMITH [2] and K.S. JOHNSON [3]

We consider karst to be more than just caves, springs, sinkholes, and other surface landforms. We define karst as an aggregate of the characteristic landforms and subsurface features produced primarily as a result of dissolution of relatively soluble minerals in rock or sediment. A total of more than 500,00 km^2 of gypsum karst and salt karst occurs in 24 structural basins or geographic areas and in rocks of every system from Ordovician through Quaternary. Although sinkholes, caves, springs, etc. occur in many of these karsts, most of them have little or no topographic expression; they are generally characterized by areal solution-subsidence features produced by subrosion of gypsum and salt. These features include breccia-pipes, widespread solution-breccias, and slump-folds in the subsurface and in outcrop. Many of these interstratal karst features are part of paleokarsts which are no longer active. Salt is exposed only in open-pit mines in Utah, but gypsum crops out in most gypsum karsts areas of the semi-arid western states. The most widespread gypsum karsts are in Permian rocks of western Texas, New Mexico, Oklahoma, and Kansas. The topography above a small percentage of salt domes is a salt karst or a gypsum karst. Locally, salt karsts and gypsum karsts are anthropogenic, a results of solution-mining or diversion of storm-water drainage. Understanding of gypsum karst and salt karst is relevant to many problems of pollution by saline groundwater in adjacent rocks, but most knowledge of these karsts is an indirect result of petroleum exploration and evaluation of potential sites for salt mines,

dams, and disposal of radioactive wastes. More would be known about such karsts if gypsum and salt occurred at shallow depths beneath urban areas where they would have both natural and anthropogenic effects upon the environment. Where gypsum occurs at depths of 100 m or less below the surface and salt at 300 m or less, dissolution has taken place; karst features formed. These features may not have been recognized but the karst is there!

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« EVAPORITE KARST IN CHINA »

YUAN DAOXIAN (1)

Three types of evaporite karst are recognized in China, namely, karst in sulfate-carbonate formation; karst in evaporites intercalated in Red Bed; and karst in evaporites deposited in modern salt lakes.

There are sulfate-carbonate formations in Midde Ordovician limestone of Northern China, and in Triassic and Sinian limestone of Southern China, each with a thickness from 20 to more than hundred meters. The main karst features in such formations are the gypsum solution breccia and the sponge-like solutional pores. The former is believed to be a mixture of residue from dissolved gypsum bed and collapse material from its overburden, some of them are paleokarst, whereas the latter is the results of dedolomitization of dolomite or dolomitic limestone, which had been intensified by the presence of sulfate solution.

Evapoites are quite common in China's Red Bed ranging from Triassic to Tertiary. Sometimes this kind of evaporite series composed of marls, gypsum, Glauber's salt, and rock salt may be as thick as several hundreds meters. Because this soluble beds are intercalated in very thick insoluble beds such as reddish sandstone, siltstone, mudstone, there are scarcely any surface karst forms. However, subsurface forms such as solutional pores, geodes, caves are encountered in tunnels or boreholes very often.

Various karst forms, for instance, salt encrustation, karren, solutional pores, and salt stalactites are reported in China's modern salt lakes, but the most important one is the salt cave. For example, in Zarhan

sal lake, Qinghai province, many vertical caves are found in rock salt bed. They are cylindrical, funnel-shaped, cone-shaped, or fissure-shaped, with diameter 0.2-1 m, and 0.3-3 m in depth generally, whereas the deepest one may be as deep as 13-17 m.

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« THE EXPERIENCE OF STUDY OF REMOVAL OF KARST AND SUFFOSION CAVITIES FILLING MATERIAL IN LABORATORY AND IN SITU EXPERIMENTS »

V.E. ZAKOPTELOV, V.M. SHUVALOV (1)

To study the mechanism of removal of filling material of karst and suffosion cavities under natural conditions is a very difficult problem, since it is really impossible to observe directly the removal of filling material, to restore hydrogeological conditions etc. The most suitable way to study the process is experimental investigation followed by mathematical statistic methods and generalization of the results obtained. A series of experiments aimed at the study of the main peculiarities of washing out of filling material under laboratory conditions has been carried by the authors. To solve this problem a model simulating jointing networks with filled cavity has been developed. In the course of the experiments conditions characteristic of karstified massif with filled cavities located in the reservoir influence zone have been simulated. The mechanism of removal of karst cavity filling material has been confirmed by experimental and in situ investigations carried out in karst regions of Perm, Sverdlovsk and Tcheljabinsk areas.

The geophysical methods of VEZ, EP, magnetic and seismic prospecting, gravitational exploration combined with boring have been applied.

The data obtained by laboratory and in situ experiments have been used to work out the methods of estimation of origin and development of suffosional process in karsted massif and to study the mechanism of removal of filling material from cavities.

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(1) Perm State University, USSR.

« INFLUENCE OF EVAPORITE KARST IN THE STREAMWATER QUALITY OF GUADALHORCE RIVER (ANDALUCIA, SPAIN) »

J. BENAVENTE HERRERA [1], F. CARRASCO CANTOS [2]

The chemical composition of groundwaters in relation with evaporite-bearing triassic materials — that crop largely over che Guadalhorce river basin (Málaga, Spain) — conditions, specially during the dry season, the quality of the streamwaters that are dammed in the lower part of the investigated area. The evaporite karst discharge is characterized by two main hydrochemical types: calcium-sulfate brackish waters and sodium-chloride brines. The former imposes the streamwater quality along the head and medium course of the river. Mixing with brines near to the tail of the dam causes to the streamwaters to become so highly saline that may rend them useless for both irrigation and human-supply purposes.

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SALT KARST IN QINGHAI PLATEAU, CHINA

GUAN YUHUA, SONG LIN HUA

The special karst features have been studied in Qarhan Salt Lake, Qinghai Plateau, where is the typical dry plateau territoriality climate with the annual average precipitation 28.1 mm and the evaporative capacity 3456 mm.

The salt dissolved poroes, crust, teeth, pits, valleys, gas-exploded holes, salt scars and many kinds of caves are developed very well by the dissolution of the meteoric water and confined flow. The absolute age, 2800-6000 years, or the equivalent efficicent age 65-130 years, of salt karst development have been calculated.

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DEL GRUPPO SPELEOLOGICO BOLOGNESE
del C.A.I.

Via dell'Indipendenza, 2 - 40121 BOLOGNA (Italia)

*

SOTTOTERRA - Rivista quadrimestrale di speleologia del Gruppo Speleologico Bolognese del C.A.I.

Direttore responsabile: Carlo D'Arpe.
Redattori: Massimo Brini, Maurizio Fabbri, Fabrizio Finotelli e Paolo Grimandi.

Autorizzazione del Tribunale di Bologna n. 3085 del 27 febbraio 1964.

Segreteria, Amministrazione e abbonamenti: G.S.B. del C.A.I., Via Indipendenza, 2 - 40121 BOLOGNA - Tel. 234856.

Abbonamento annuo:
L. 6.000 - Una copia L. 2.500 - Estero L. 12.000 - Una copia L. 5.000.

Versamenti su C. C. postale n. 20045407 - Gratuito per le Associazioni Speleologiche Italiane ed Estere con le quali si effettui scambio di pubblicazioni periodiche.

CASA EDITRICE CONTI

Arti Grafiche Conti - Bologna - Via del Fossato, 4/2 - Tel 051/33 27 05