ACTA CARSOLOGICA	XXVII/2	4	63-74	LJUBLJANA 1998

COBISS: 1.08

ORIGIN AND DEVELOPMENT OF CAVE SYSTEM IN THE ROSANDRA VALLEY (CLASSICAL KARST - ITALY)

NASTANEK IN RAZVOJ JAMSKEGA SISTEMA V DOLINI GLINŠČICE (KLASIČNI KRAS - ITALIJA)

CUCCHI F.[1] & POTLECA M. & ZINI L.

[1] Dipartimento di Scienze Geologiche, Ambientali e Marine, University of Trieste - ITALY

Prejeto / received: 5. 5. 1998

Izvleček UDK: 556.3 (450)

Cucchi F. & Potleca M. & Zini L.: Nastanek in razvoj jamskega sistema v dolini Glinščice (Klasični Kras - Italija)

V terciarnih apnencih zgornjega dela doline Glinščice je jamski sistem Savi - Fessura del Vento, v ozemlju, kjer je intenzivna tektonika povzročila vrsto narivov, pomešanih s prelomi. V dolini Glinščice in v tamkajšnjih jamah je nekaj ključnih dejstev v dokaz, da je najmlajša tektonika vplivala tako na površinsko (neenakomernost pobočij, skoki in spremembe smeri teka Glinščice) kot na podzemeljsko morfologijo (premaknjene korozijske oblike, podori in druge morfološke oblike).
Ključne besede: speleogeneza, hidrologija krasa, Klasični Kras, Italija.

Abstract UDC: 556.3 (450)

Cucchi F. & Potleca M. & Zini L.: Origin and development of cave system in the Rosandra Valley (Classical Karst - Italy)

The system Savi - Fessura del Vento caves occurs in the Rosandra Valley Tertiary limestones in an area where intense tectonic influences have caused a series of overthrusts mixed with faults. In Rosandra Valley's area and in its caves there are some clues reporting recent tectonics which have conditioned both, epigean (slope irregularities, falls and variations of directions along the course of Rosandra creek) and hypogean morphologies (displaced solution forms, breakdowns and other morphologies).
Key words: speleogenesis, karst hydrology, Classical Karst (Italy).

Introduction

The present study will explain the origin and development of cave systems in the Rosandra Valley, which is located in the south-east of the Karst of Trieste and has a fluvial-karstic origin.

The Trieste Karst reflects a relative old karst evolving since almost ten million year ago: the initial superficial morphologies (planation surfaces which have evolved in the shape of a polje system subject to prevailingly compressive tectonics) are hard to distinguish, as much so as the deep collapse Pliocene dolines.

The cavities maintain rare primary morphologies affected by filling deposits, breakdowns and concretions, which contemporarily modify other depths due to baseline level changes and to adaptations to tectonic movements.

The Rosandra Valley zone presents a peculiar geological setting when compared to other zones of the Karst platform and it is also different in the development trends of the caves,.

The geology of the area is quite different from that of the Karst plateau and it is, from a structural point of view, very similar to the one of north-eastern Istria (Čičarija).

Tertiary rocks, both carbonate and silicoclastic, irregularly covered by Quaternary loose deposits outcrop in the area of the Rosandra Valley (Cucchi, Pirini, Pugliese, 1987).

We find light or dark limestones, very fossiliferous and filled by Foraminifera, with not very evident bedding, polydecimetric period, thickness up to 300 m. (*Opicina" Member,* Paleocene-Eocene in age, with medium-high karstification) and turbiditic marls and sandstones with very evident interbedding, thickness up to 500m (*Flysch Fm.*, Eocene in age, non karstifiable).

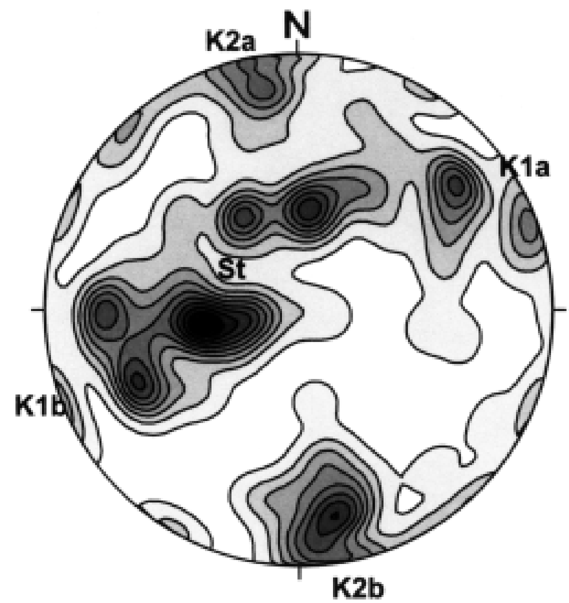

Fig. 1: Statistical joint system. Contour lines of poles on the Schmidt diagram, inferior hemisphere. Maxima: St = bedding, K1, and K2 indicate the two preferential joint sets.

The valley is placed on a secondary syncline, cut off toward NE whose northerly side is complicated by several faults and overthrusts. A squat and smoothed anticline complicates the southern part of the area and lies the contact, by faults and/or stratigraphic limits, between the limestone and the Flysch (Cucchi, Vaia, Finocchiaro, 1987). The structural sketch shows a general stress with dinaric directions (NE-SW with NW-SE structural axis).

Data collected indicate the presence of three main discontinuity sets: one of these is represented by strata with continue undulation from W-E direction with 20°-30° Northward dip, to N-S with 15°-20° Eastward dip (St poles in figure 1). The others two groups presents joints with variable Eastward or Westward inclination and N-S, NNW-SSE direction (K1a and K1b planes in figure 1) and other subvertical Northward dipping planes with E-W direction (K2 planes in figure 1).

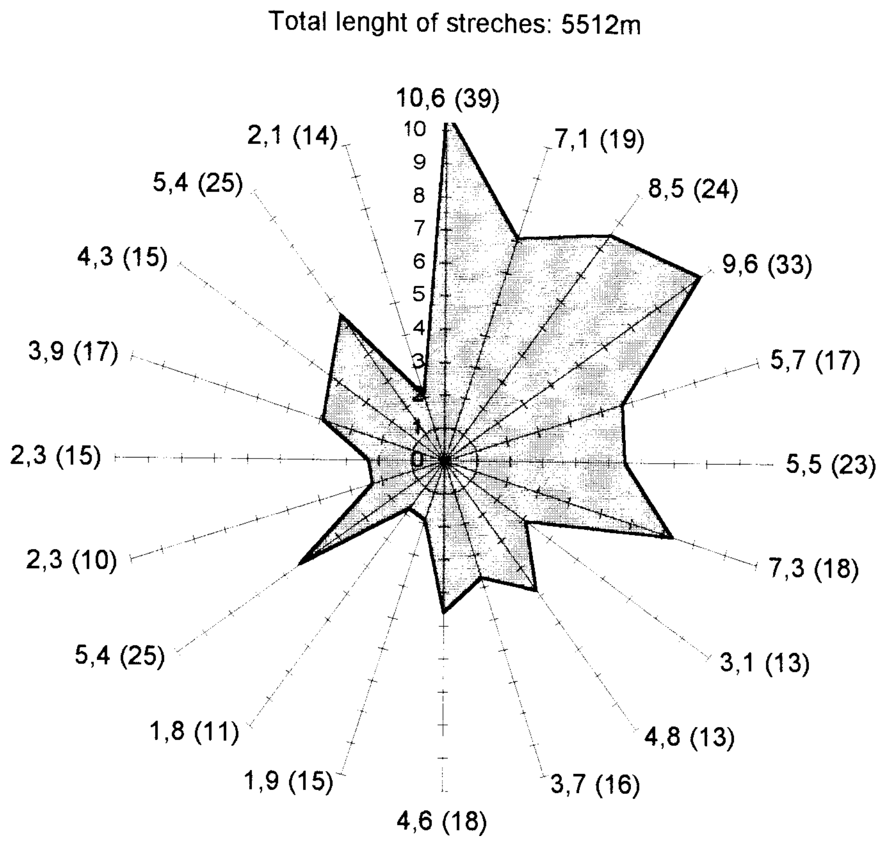

Fig. 2: Stellar diagram of preferential directions of development of the caves in the Rosandra area. Numerals on the left express percents of total length, numeral at right expresses numbers of passages in the considered direction.

Caves network

In the carbonate massifs which form the Rosandra Valley sides there are many caves. They are part of a complex cave system and their evolution is conditioned more by lithologic -structural features than by base level variations.

On the right side of the Valley, there is a network of long horizontal galleries belonging to two principal cave systems: the Gualtiero Savi cave at more than 200 metre higher than the local base (with entrance nowadays at 350 m a.s.l.) and more than 5 km of total development and Fessura del Vento cave at more than 100 metre higher than the local base (entrance at 250 m a.s.l.) and more than 2 km of total development.

The analysis of development direction lines followed by caves of the area which has been elaborate in direction, inclination and length of all cave segments, shows (figure 2) that more of 50% of the stretch is developed in direction within first quadrant (N, NE, E).

This comportment is very different from that of the other Classical Karst caves, which have a preferential trend toward SW and W and this karst zone must have a different evolutive speleogenetic model from the remaining area one.

The "Rosandra Valley zone" presents a peculiar geological setting when compared to other zones of the Karst platform and, as for the development trends of the caves, it is also different: the most important are N, S, NE, SW, well correlated to the geological - structural features.

The system Savi - Fessura del Vento caves occurs in the Rosandra Valley Tertiary limestones in an area where intense tectonic influences have caused a series of overthrusts mixed with faults (figures 3, 4, 5). In the Rosandra Valley area and in its caves there are some clues reporting recent tectonics which have conditioned both epigean (slope irregularities, falls and variations of directions along the course of Rosandra creek) and hypogean morphologies (displaced solution forms, breakdowns and other morphologies).

Caves morphology

From the geo-morphological point of view, the cave systems can be subdivided in some stretches with similar morphological features (figure 6).

Anyway we can recognise (figure 7):

- paragenetic galleries with scallops sometimes. On the floor speleothems cover poligenic conglomerate and very thick clay; we can find these deposits higher and lower at the speleothems.
- large chambers with impressive breakdowns, locally covered by flowstones.
- singenetic narrow trenches or meanders with scallops, conglomerates and clay; sometimes in trenches we can also find breakdown and flowstones.

Faults and large joints influence morphology and development of the cave systems; in fact evidence of recent movements on fault planes in gallery and chambers is frequent. We can observe two main overthrusts (limestone overthrust Flysch) and a tectonic zone, where faults and large joints influence more the cave development.

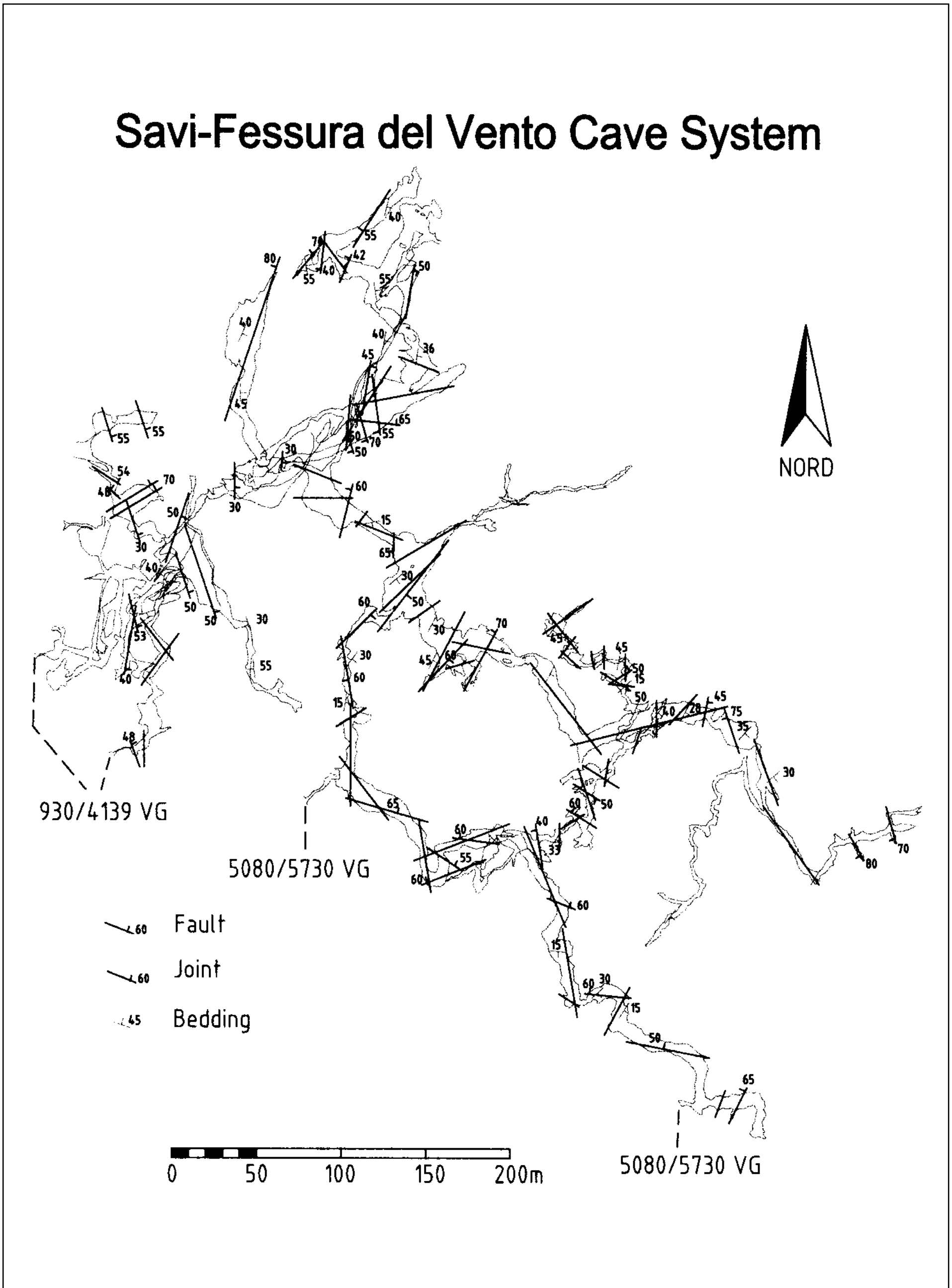

Fig. 3: Plan with main discontinuity plans of Savi Cave (cadastral number 5080/5730VG) and Fessura del Vento Cave (cadastral number 930/4139VG).

Speleogenesis

The cave system can be divided in three principal levels placed respectively at 350 m a.s.l., at 300 m a.s.l. and at 200 m a.s.l. Morphogenetic and developing analysis can suggest at least four subsequent speleogenetic phases (figures 8, 9) but unfortunately it is very difficult to date them because we know only the Chatian-Langhian age of the original planation surface (20 Ma BP?) and the age of the last significant speleothems (120.000 years at least).

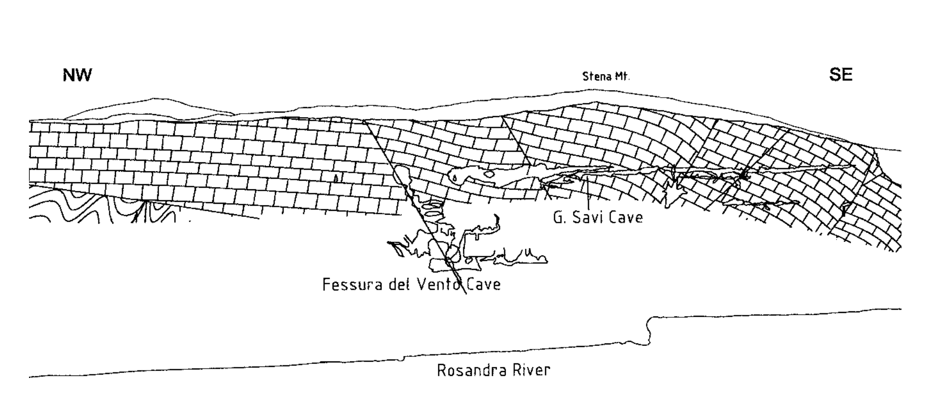

Fig. 4: Geological section NE-SW oriented of Savi-Fessura del Vento Cave System.

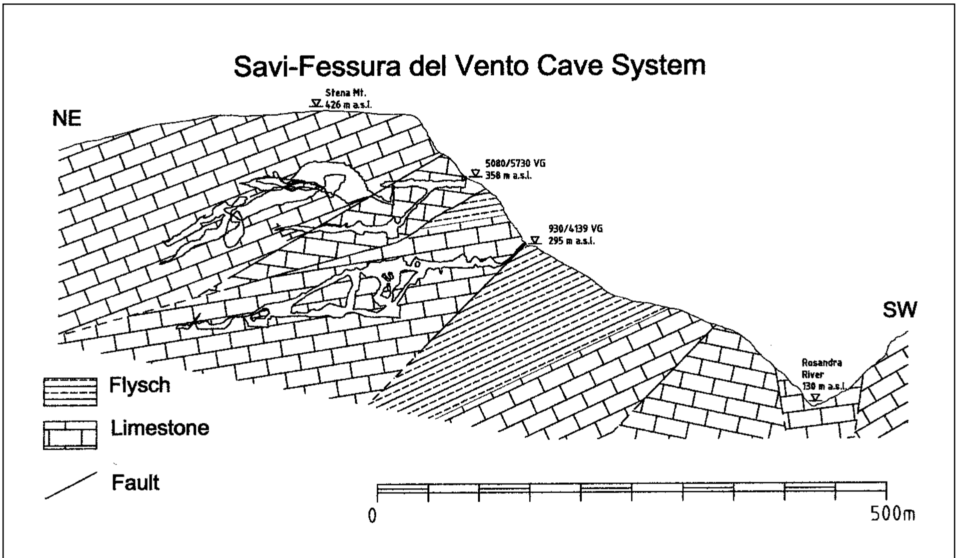

Fig. 5: Geological section NW-SE oriented of Savi-Fessura del Vento Cave System.

In the 1st phase we can observe the development of a network of galleries (today at 350 a.s.l.) draining a lot of waters coming from Flysch basins (sketch A in figures 8, 9). From the paleotectonic point of view, a standstill period of orogenetic thrust has favoured this phase which has provoked galleries along NE-SW planes.

The 2nd phase can be divided in two periods: during the first the cave system experienced intense collapse that produces ample halls. The drain of the waters in depth is favoured by movements along fault planes or bands of faults. The base level lowers and rivers erode limestone and Flysch. During floods the cave system is filled by clay and conglomerate. The renewal of tectonic compression is one of main genetic factors of this phase.

In a second stage of the second period the valley becomes deeper, new lower entrances open as sinkholes and a lower cave system appears, with partial emptying of cave interior deposits. As a consequence of renewal orogenetic activity there is also a general lifting of the area.

In the 3rd phase, because of further deepening of the valley, high galleries become fossil, new entrances (Fessura del Vento cave at 250 m a.s.l.) open lower, and the connection between old and new cave systems occurs. During this 3rd phase the weak trascurrent action along faults perpendicular to overthrusts (i. e. parallel to mean stress) plays an important role.

Finally, during the 4th phase, quick erosion continues because of the general lifting of the area, all entrances become fossil, speleothems fill caves and increase the morphostructural evolution of the valley. Today the local base level is the bed of the Rosandra river at around 100 m a.s.l.

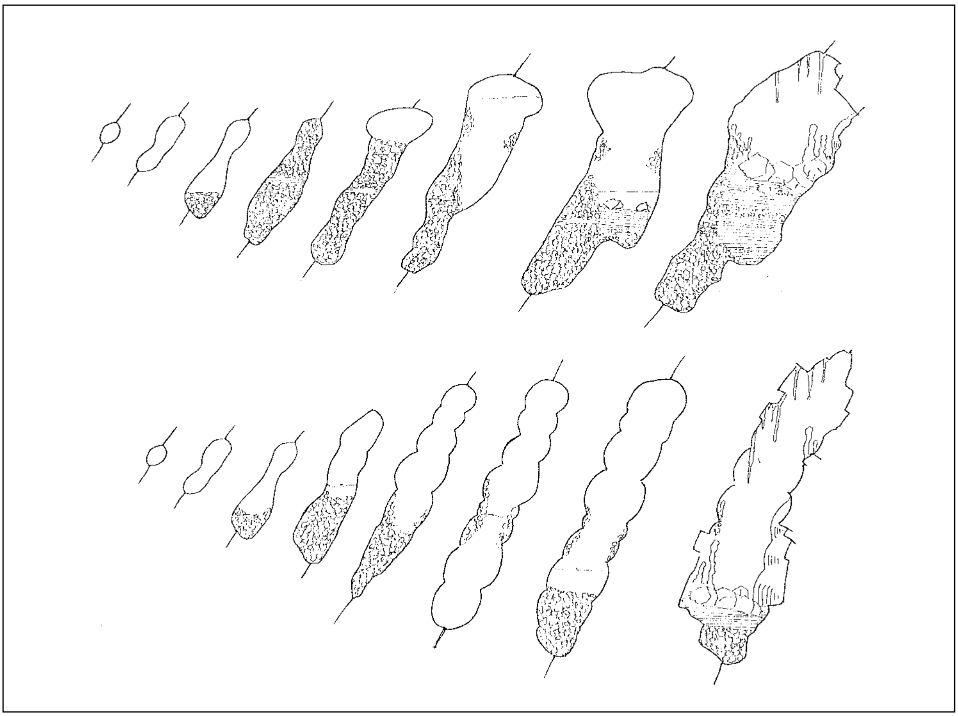

Fig. 6: Cross sections evolution and morphotypes recognised.

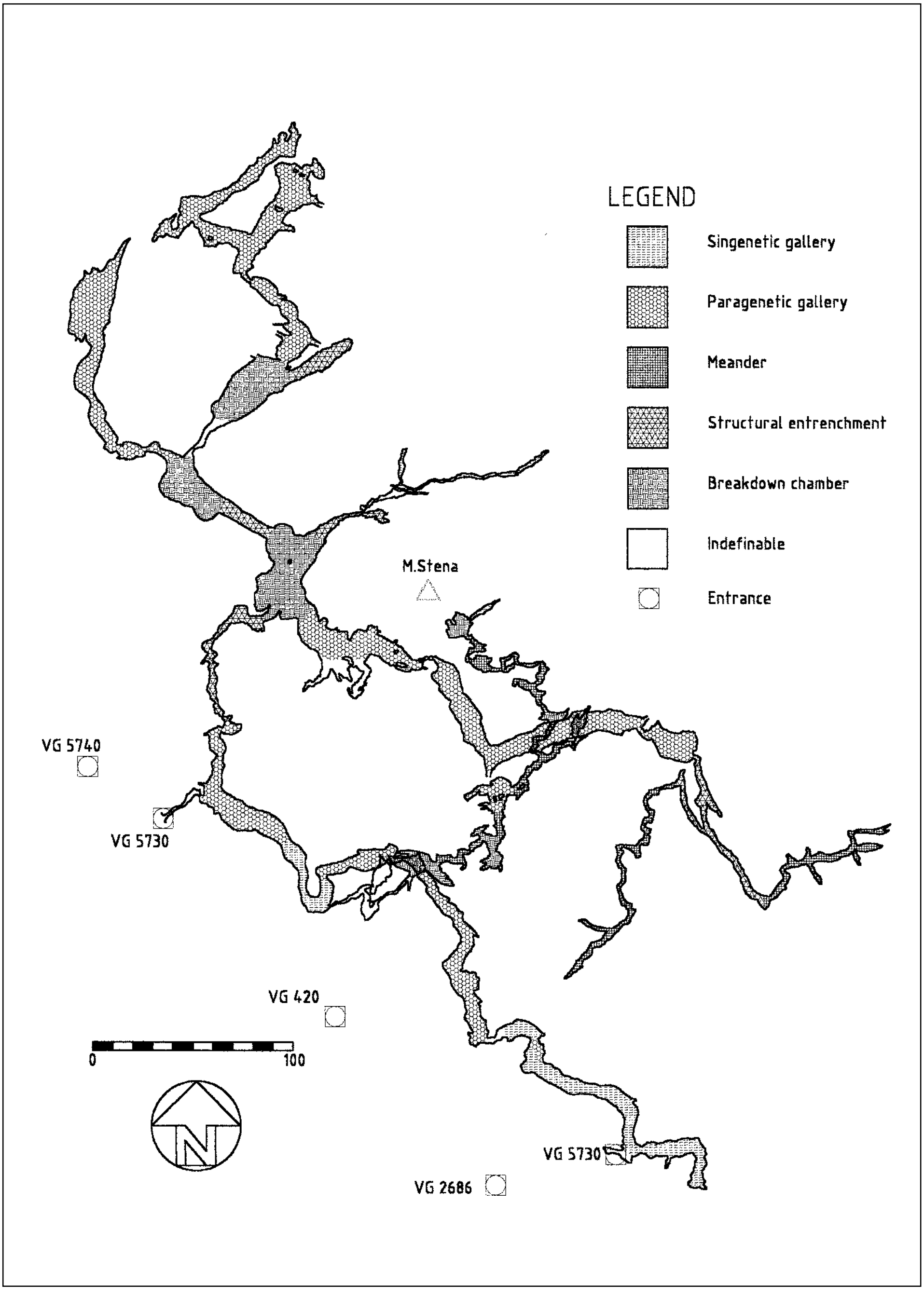

Fig. 7: Stretches with similar morphological features in the Savi cave.

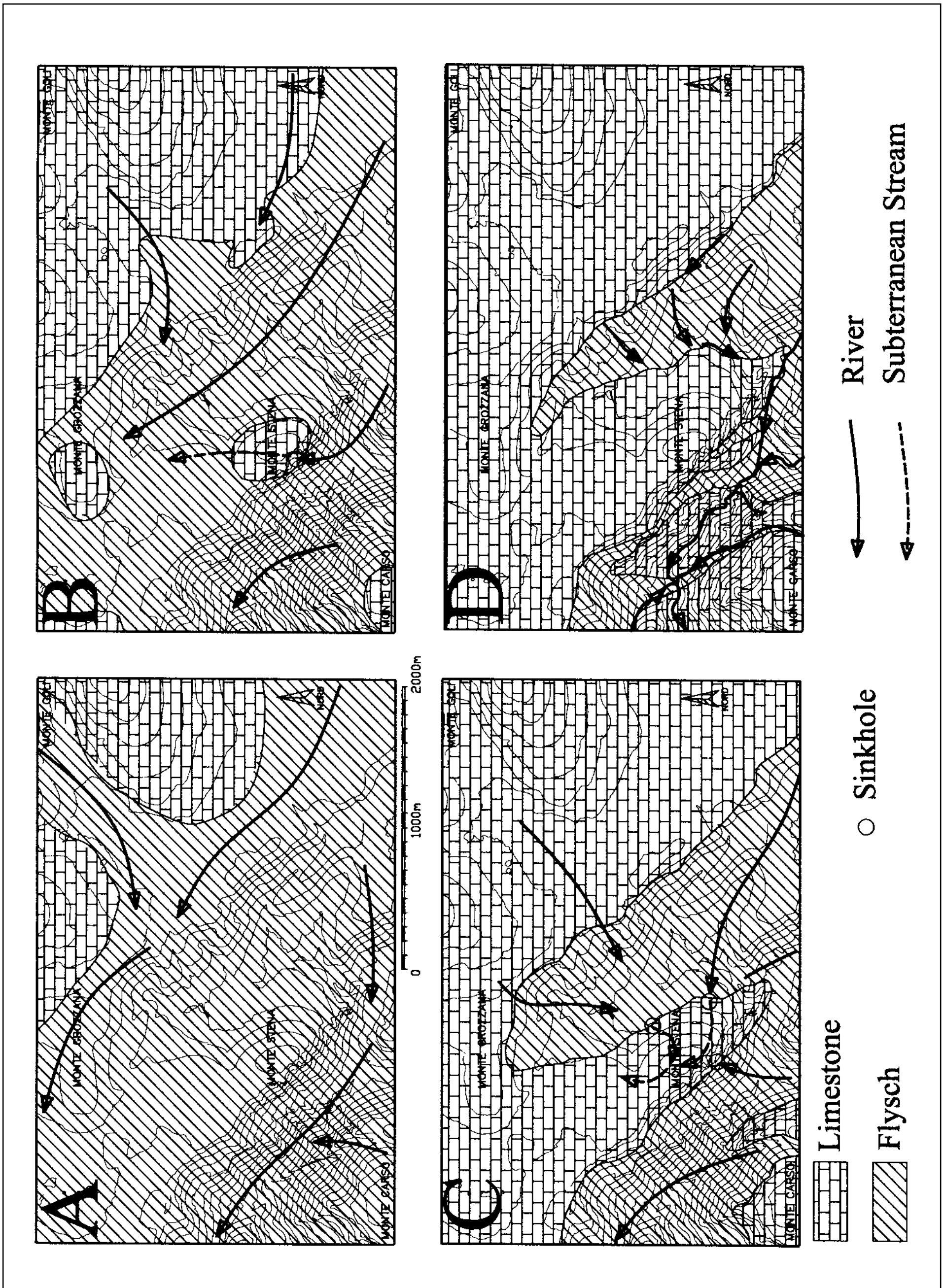

Fig. 8: Subsequent superficial speleogenetic phases.

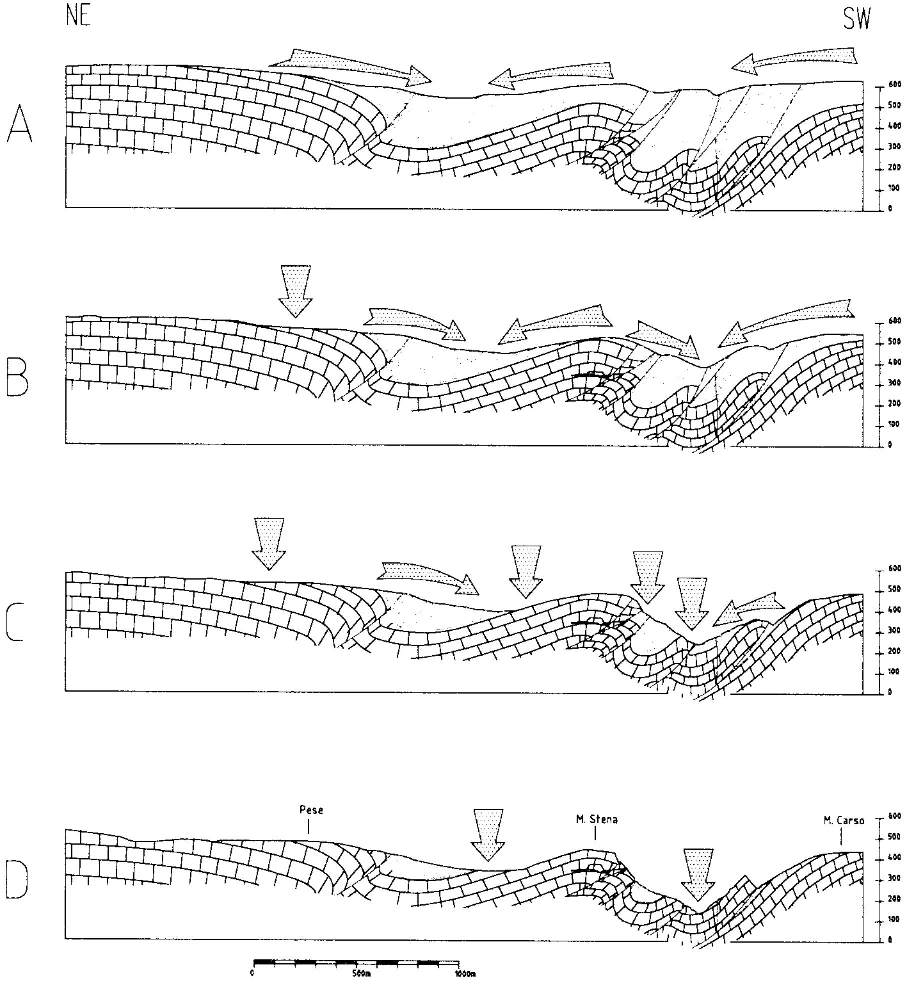

Fig. 9: Subsequent speleogenetic phases.

BIBLIOGRAPHY

CUCCHI F., DE LA ORDEN J.A., ERASO A., FERNANDEZ J., TORELLI L. (1995) **-** Application of the directional prediction method to the drainage of the Reka-Timavo underground river. *Acta Carsologica.* **XXIV,** 188-202. Ljubljana

CUCCHI F., FORTI F., SEMERARO R. (1978) - Indizi di neotettonica in cavità della Val Rosandra. *Atti e Memorie Comm. Grotte "E. Boegan".* Vol. **XVIII**, 105-109. Trieste.

CUCCHI F., PIRINI RADRIZZANI C. & PUGLIESE N. (1987) - The carbonate stratifigraphic sequence of the Karst of Triest . *Mem. Soc. Geol. It.,* **XL,** 21-34 , Roma

CUCCHI F., VAIA F. & FINOCCHIARO F. (1987) - The geology of the T. Rosandra Valley. *Mem. Soc. Geol. It.,* **XL,** 67-72, Roma

HABIČ P. (1983) - Reliefne enote in strukturnice matičnega Krasa. *Acta Carsologica,* **XII/1**, 5-26. Ljubljana

PLACER L. (1981) - Geologic structure of S.W. Slovenia. *Geologija,* **24/1** , 27-60. Ljubljana

NASTANEK IN RAZVOJ JAMSKEGA SISTEMA V DOLINI GLINŠČICE (KLASIČNI KRAS - ITALIJA)

Povzetek

Predstavljeni model razvoja krasa v dolini Glinščice temelji na medsebojni odvisnosti številnih geomorfoloških, geološko-strukturnih in sedimentoloških elementov, ki so značilni za to dolino. Večina jam obravnavanega področja, ki so danes prerezane zaradi zaostajanja v vrezovanju JZ pobočja M. Stene, je povezana s starimi singenetskimi rovi, močno preoblikovanimi v kasnejših obdobjih tako zaradi izvotljevanja kot zaradi podorov in nato zaradi zapolnjevanja z nanosi.

V začetku se je kraški sistem razvjal s pomočjo oblikovanja pretežno vodoravnih rovov, potekajočih predvsem vzdolž smeri največjega naklona plasti ali ob presečišču teh plasti s subvertikalnimi prelomi. Nadmorska višina rovov nakazuje, da je večina nivojev nastala 360-350 m. n.m. Ostanki višjih nivojev so bili odkriti le na nekaterih mestih, saj so bila ta skoraj popolnoma izključena iz kasnejših procesov uravnavanja; glede na geomorfološke in strukturne podatke lahko nastanek teh nivojev pripišemo epifreatičnemu okolju pod lapornato-peščenim pokrovom.

Ob ponovni orogenetski dejavnosti se je piezometrični nivo na splošno znižal, pretok potokov v zaledju se je zmanjšal zaradi povečanega odstranjevanja flišnega pokrova, rovi so se razvijali gravitacijsko, velikih dvorane so se večale zaradi udorov, med poplavami sta se odlagala konglomerat in glina, vodne poti vzdolž subvertikalnih prelomov so se poglabljale in prevladovalo je razpršeno površinsko zakrasevanje. Ko voda teh rovov ni več poglabljala in večala, sta se pričela odlagati siga in mehanski sedimentov.

Lahko sklenemo, da je nastanek krasa tega ozemlja tesno povezan s strukturo ter z morfološkimi in hidrološkimi spremembami na površju.