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TENG LONG DONG

THE LONGEST CAVE OF CHINA

REPORT ON THE FIRST BELGIAN-CHINESE SPELEOLOGICAL EXPEDITION IN 1988

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PART THREE

CAVE SCIENTIFIC RESEARCH

MORPHOLOGY: MAPPING THE GENESIS OF THE FLYING DRAGON.

Of course Tenglong has a complex history, including the excavation by a river, other actions of the water and breakdowns. Some of the latter could have been reworked by subsequent riveraction as well. The final process which contributed to cavedevelopment is not the same everywhere. This is why we mapped the erosion agents which shaped the cave on a part of the groundplan of Tenglong (fig. 4).

We distinguish first those portions of the cave whose present morphology is due to a fluvial action. This shows that most of the upper fossillevel of the cave was also created by the underground Qingjiang.

Secondly we distinguish the sections shaped by water, but not necesarilly a river. In one place, East of Yaowushan, the roof is incised by a deep meandering trench, remnant of a flow passing over the sediments which totally blocked the cave at some earlier epoch. In another place, West of Yaowushan, the stream has been flowing in a sump, thus presenting a rather tubular section, convex downward. In other places, all along the river- made gallery, pits, chimneys and small annexes definitely show the mark of wateraction, but not of a true river.

Finally, collapse zones are indicated on the map: these collapsezones generally enlarged some of the riverpassages, sometimes at the crossing of two galleries. This is easy to show on the map. In some places, the breakdowns only affected the roof of the gallery, increasing the altitude of the ceiling.

If most of the breakdowns struck the cave after the fluvial stage, some of them, though not many, were remodelled by riveraction: the collapsed blocks show erosionmarks (flutes, stream scallops,...). In some other places, the fallen blocks have disappeared and only the shape of the roof tells us about a breakdown. The blocks could have been removed by dissolution or covered by a subsequent sandy alluvial mat.

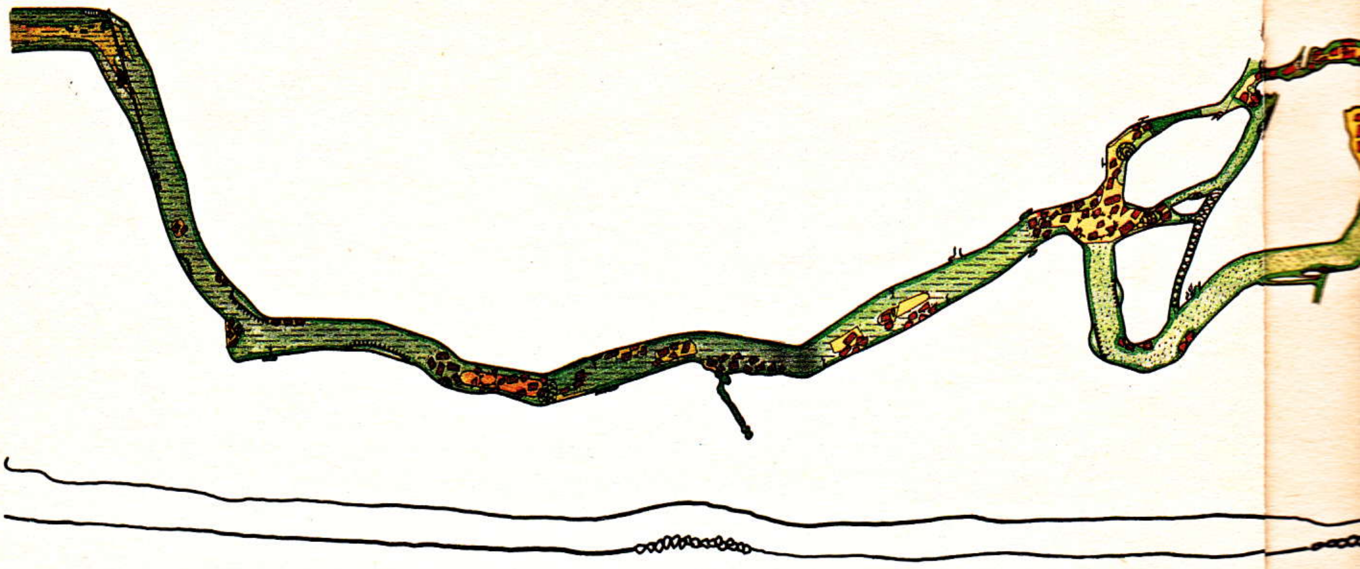
In some places at last, big fallen blocks appear under a roof, displaying no trace of breakdown. This can be because of a later remodelling of the walls by riveraction; but then one wonders why the blocks themselves eroded. In some cases, it is likely that some blocks were displaced, carried away during floods.

Let us finally stress upon the titanic sizes of some of the fallen blocks : some of them, at the foot of Yaowushan, measure no less than 12 m x 10 m, the third dimension being unknown.

- STREAMACTION
- PHREATIC CAVE
- BREAKDOWN ZONE
- FALLEN ROCKS
- SAND
- SILT OR CLAY
- SAND AND SILT
- RIMSTONEDAMS
- SPRINGS
- ROCKPENDANTS
- FRACTURE
- FISSURE

TENGLONG DONG THE FOSSIL GALLERY MORPHOGENETIC MAP

Fig 4. Tenglong Dong The fossil gallery morphongenetic map

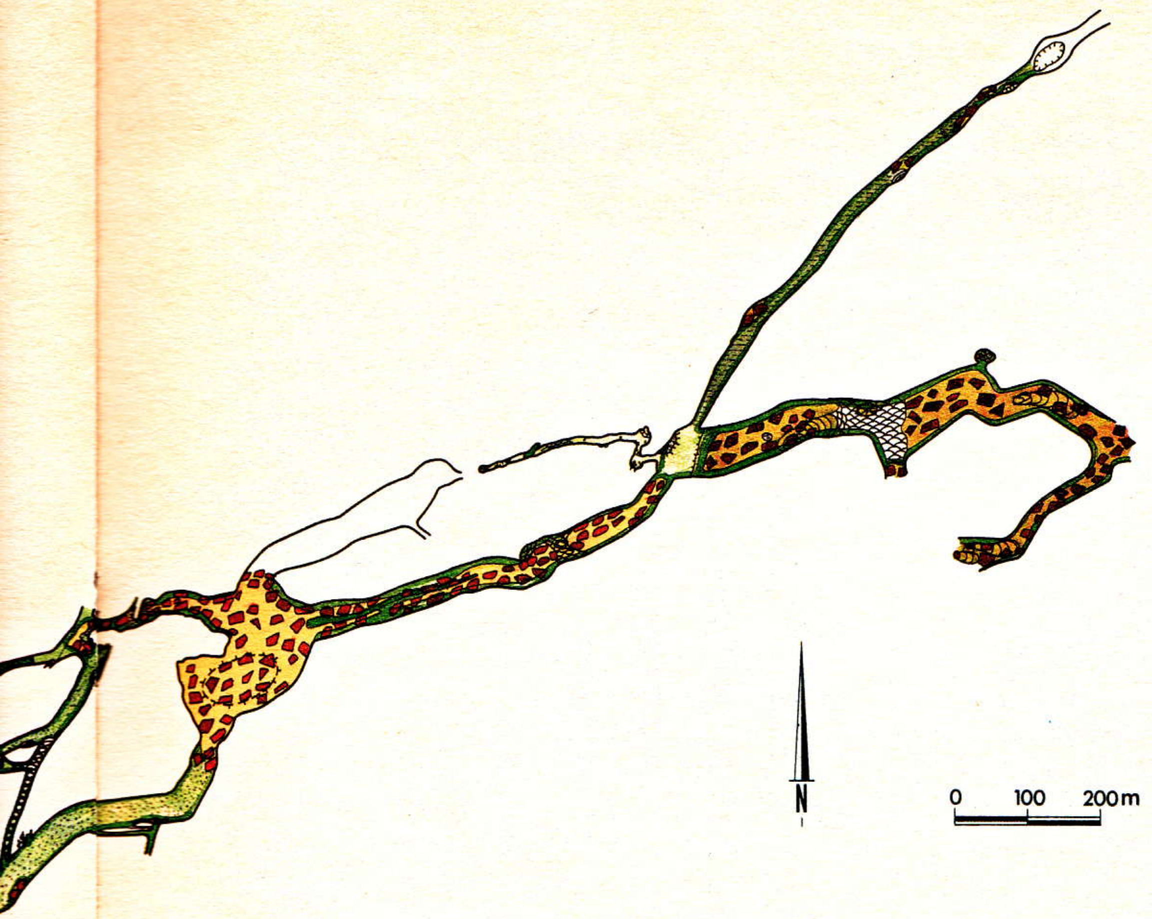


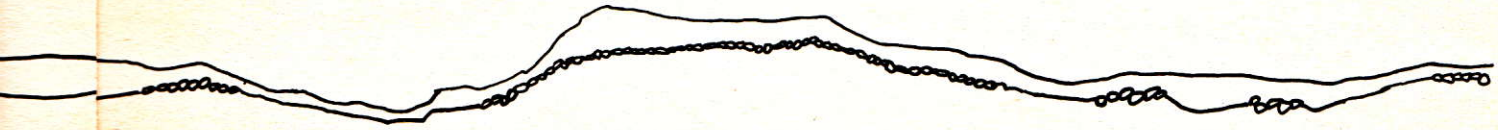
GEOLOGICAL INFLUENCES, CONTROLS ON THE CAVE LOCATION

Tenglong cave developed in the transitionbeds between T1d or Daye Formation and T1j or Jialinjiang Formation, composed of rather thick limestonebeds at the north eastern slope of the Jinzishan synclinorium, striking N60E. In the north, the T1d beds are updoming in several secondary anticlines belonging to the Lichuan anticlinorium. This T1d-T1j transition has also a marked impact on the regional karstmorphology. In this way the location of the Tenglong Dong system is stratigraphically controlled.

Differences in bedding and jointing form a structural control on the type of karstic dissolution and erosion. The mostly vertical joints are widened as fissures by percolating water allowing corrosion of the limestone. A network of open fissures or diaclases was preserved in the Puzzle Palace along the White Dragon gallery. The major galleries also tend to follow joint- and fracturedirections. They increase in height as a result of roof collapse in the jointed rock units which will halt when a massive unit is reached.

The increase in frequency of joints and shalepartings in the lower T1d beds will diminish the average dimensions of the cavities in these beds, cause obstructions by collapse and accumulation of insolubles, form traps for allochtonous sediments and eventually prevent accessibility to the karstsystem. This is best noticed in the zones where T1d beds are updoming in small secondary anticlines, probably of limited geographical extension and tapering out upwards in the more massive T1j units.



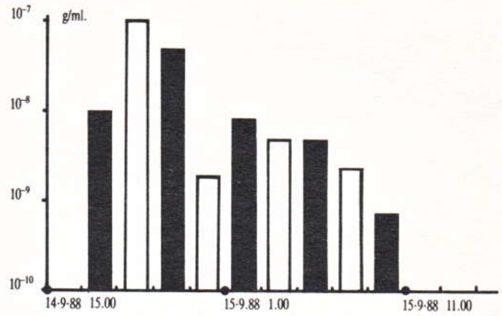


Whereas the average dips in the Lichuan limestones are 10-20°, these can increase to 50-75° in anticlinal structures. Fracturing and faulting are also associated with these anticlines. As a consequence, tectonic style exerts an additional control on cavedevelopment: the anticlinal zones deflect cave development and induce rockfalls and reduction of gallerysize. Thus, these parts of the Tenglong Dong system are less developed and seriously complicated the exploration.

CAVE HYDROGEOLOGY: A STRAIGHTFORWARD RIVER.

The water course of the Qingjiang river in Tenglong is almost a straight line, a major conduit about 10 km long running along stratification of the dissolved limestonebeds, occasionally overflowing into normally dry galleries during floods. Many tributaries or outcrops of water have been noticed between the entrance and the outlet. By the means of tracingexperiments and wateranalyses, an attempt was made to distinguish the real tributaries and the diffluences of the river itself. Because of an extended catchmentarea covering mainly poorly permeable rocks or deeply corroded limestones in the polje, the discharge of the Qingjiang river at the cave entrance is largely fluctuating, ranging from 1.33 m3/s to more than 50 m3/s. As a consequence, the watertable may rise more than ten meters in smaller passages. No lakes, nor extensive phreatic volumes are large enough to reduce the amplitudes of these variations, as is confirmed by the results of the tracingexperiment carried out from the entrance to the resurgence (fig. 5). The uranine (10 kg) put in the Qingjiang river took less than 5 hours before coming out at the resurgence. The maximum was reached two hours later and the total time of restitution was only 17 hours. Also Milk Way, Water Well Cave (Shuijing Dong) and a shaft in the canyon were reached by the tracer, being on the way of the undergroundriver. It was clear that some vadose springs, like the one in Fish cave or Koens passage, were not connected with the main stream. Other connections (Xiangshui, Longu, Guancai) were not confirmed owing to sampling problems. Some temporary streams go through the huge dry gallery of Tenglong. They are infiltrations of percolating rainwater observed on the right bank and joining the river through phreatic conduits. One must distinguish these from the tributaries to the north or left bank which directly drain more diffuse aquifers. An attempt was made, to show a connection between Cold Wind cave river and Oxnose Cave through the dry valley. This connection is probably only effective during higher waters. The injected rhodamine B allowed us to measure the discharge of this river using the dilutionmethod. These preliminary hydrogeological investigations according to the established flow pattern, are likely to lead to a better understanding of the groundwaterresources of the Lichuan area.

Fig. 5: Variation of concentration of uranine in extracts of active charcoal, sampled every two hours during the tracingtest from Tenglong sink to the Black Cave resurgence. The injected quantity was 10 kg just at the end of a flood event.



Sportive caving in Longu Dong.