

# **PS Fault Controlling of Non-Exposed Karst Reservoir in Halahatang District in North Tarim Basin\***

**Ke Ma<sup>1</sup> and Jiagen Hou<sup>1</sup>**

Search and Discovery Article #10800 (2015)\*\*

Posted November 30, 2015

\*Adapted from poster presentation given at AAPG/SEG International Conference & Exhibition, Melbourne, Australia, September 13-16, 2015

\*\*Datapages © 2015 Serial rights given by author. For all other rights contact author directly.

<sup>1</sup>College of Geosciences, China University of Petroleum, Beijing, China ([779576547@qq.com](mailto:779576547@qq.com))

## **Abstract**

The marine facies fracture-vug reservoirs in the Tarim Basin have complicated evolutionary mechanisms and heterogeneity. We chose buried hill district where interlayered karst develops in the Halahatang district in northern Tarim Basin, using certain data as core, imaging logging and slice samples to study the characteristic of fractures. We conclude that three phases of structural fractures developed in the buried hill district, in which the one from the middle Caledonian is effective. Combined with 3D seismic data, tectonic background, reservoir prediction and relationship between fractures issue and tectonic movement, we conclude that strike slip faulting in the middle and late Caledonian to early Hercynian contributed significantly in the development of the karst reservoir in the buried hill district. The faults in the middle Caledonian further developed into main faults, which have the largest separation. They influenced fracture-vug reservoirs in two ways: accelerating the development of karst reservoir and destructing oil deposits. The late Caledonian to early Hercynian faults controlled karst reservoirs in three ways: they extend to ground surface and thus precipitate vertical karstification; the fractures of multi-issues and scales that associated with the faults increased the contacting area of limestone and meteoric fresh water, which will improve the vertical connectivity and quality of fracture-vug reservoirs; oil and gas were blocked because these faults has small separation. In exploration and well planation in carbonate marine facies, typical weathering crust reservoirs and reservoirs controlled by multi-scale faults should be considered further. Karst reservoirs controlled by faults will gradually become an important target in north Tarim Basin.

## 1. INTRODUCTION

We choose buried hill district where interlayer karst develops in Halahatang oilfield in north Tarim Basin as example, get the conclusion that 3 issues of structural fractures developed. And we concluded that the strike slip faults in middle and late Caledonian to early Hercynian contributed most in development of the karst reservoir. The faults in middle Caledonian influenced fracture-cavity reservoirs in two ways: accelerating the development of karst reservoir and destructing oil deposit. The late Caledonian to early Hercynian faults controlled karst reservoirs in 3 aspects: precipitate vertical karstification; the fractures increased the contacting area of limestone and meteoric water;

## 3. RESULTS

### 3.1 The classification of reservoirs

- Tubulose underground river caves: extended horizontally
- Caves controlled by faults and rivers(such as doline caves)
- Caves controlled by faults(such as discrete caves)
- Fracture-cavity in early stage
- micro fracture-cavity in late stage

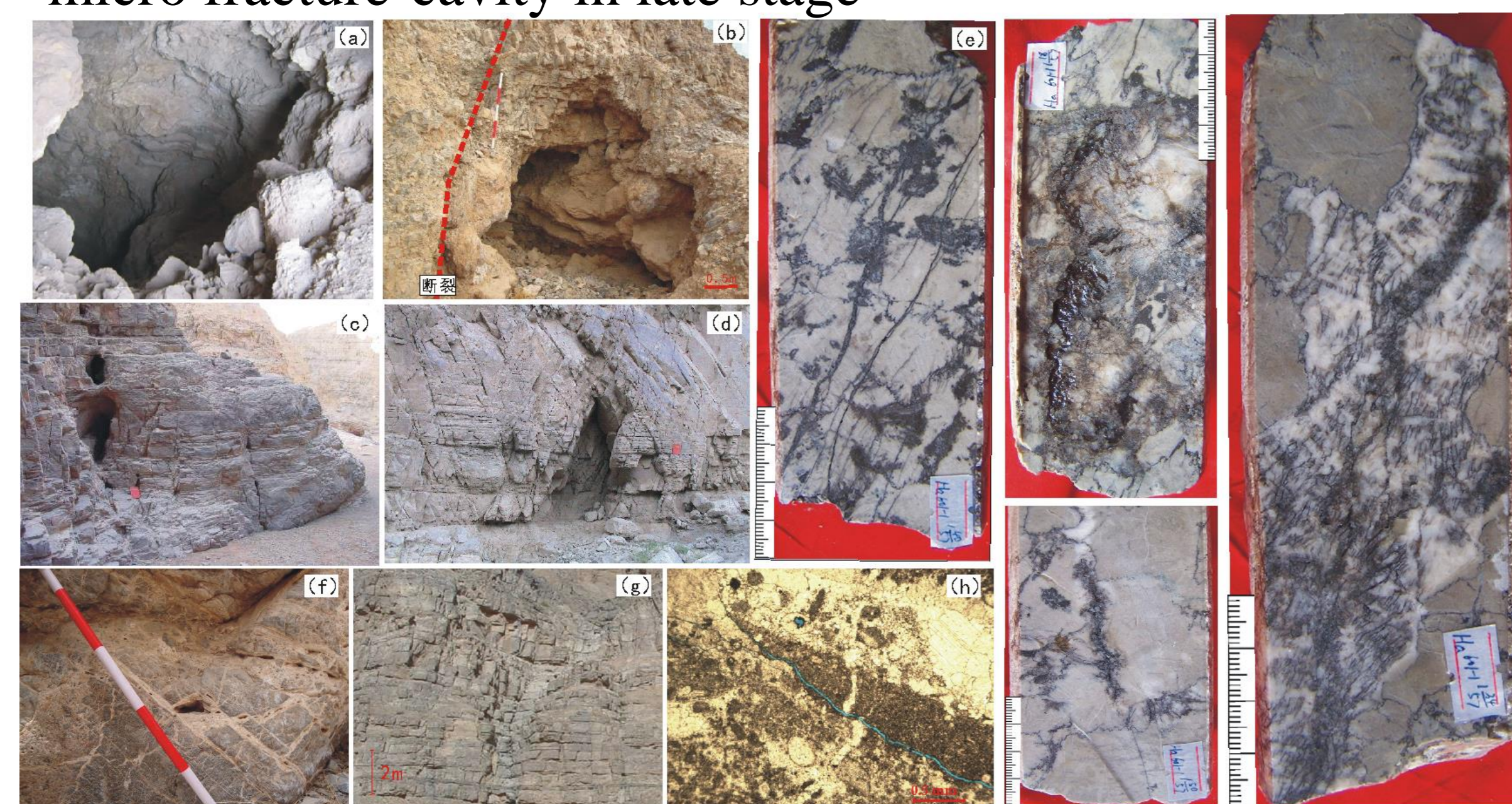


Fig.1 Characteristics of fracture-cavity in outcrops, cores, and slice samples

### 3.2 The identification of reservoir and fracture issue

- We identified five different types of seismic response, and they can reflect different kinds of fracture-cavity reservoir.
- Divide the faults into two phases and three levels and the fracture into three phases and three levels.

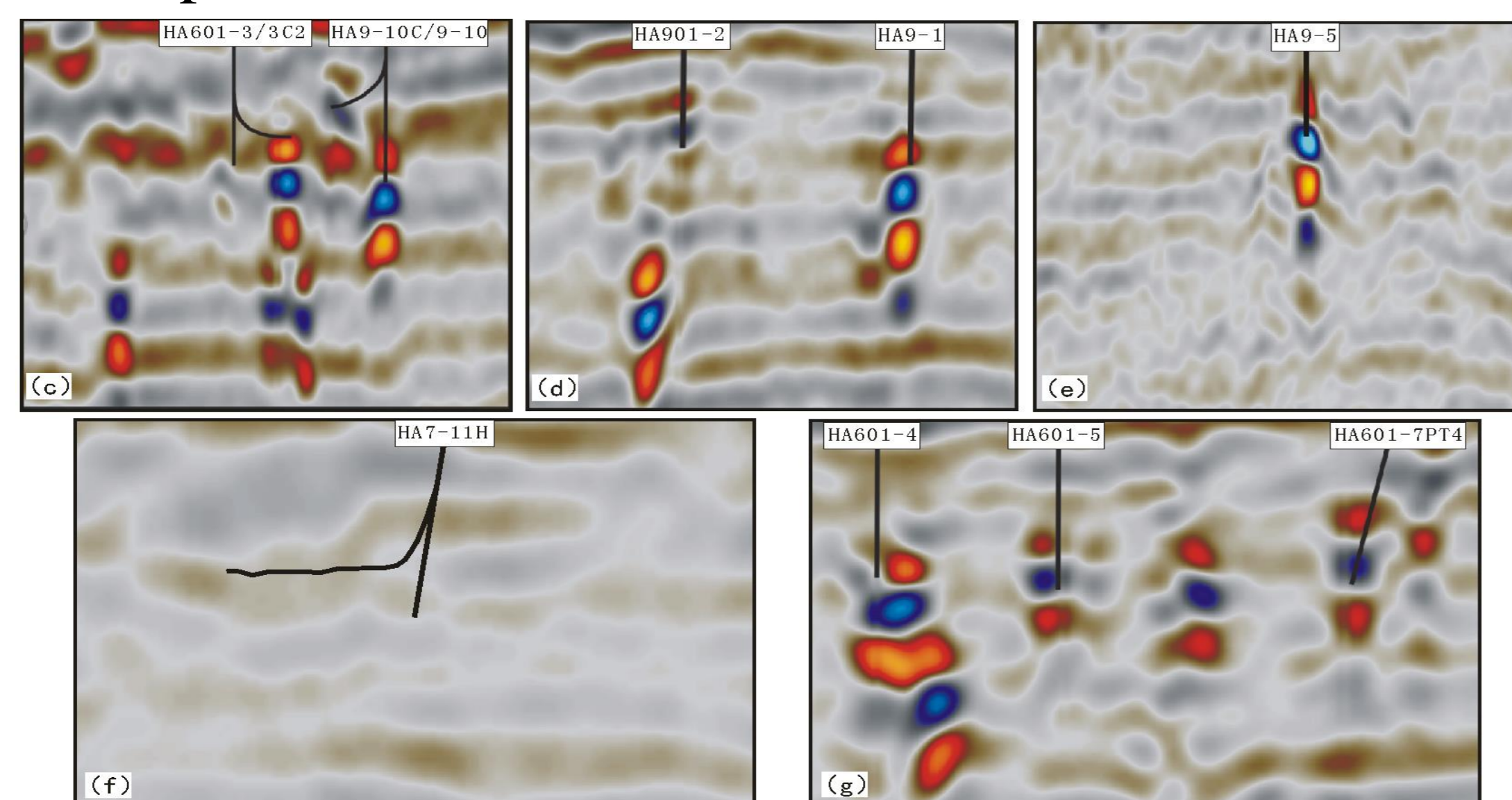


Fig.2 Seismic response characteristics of Ordovician fracture-cavity reservoir

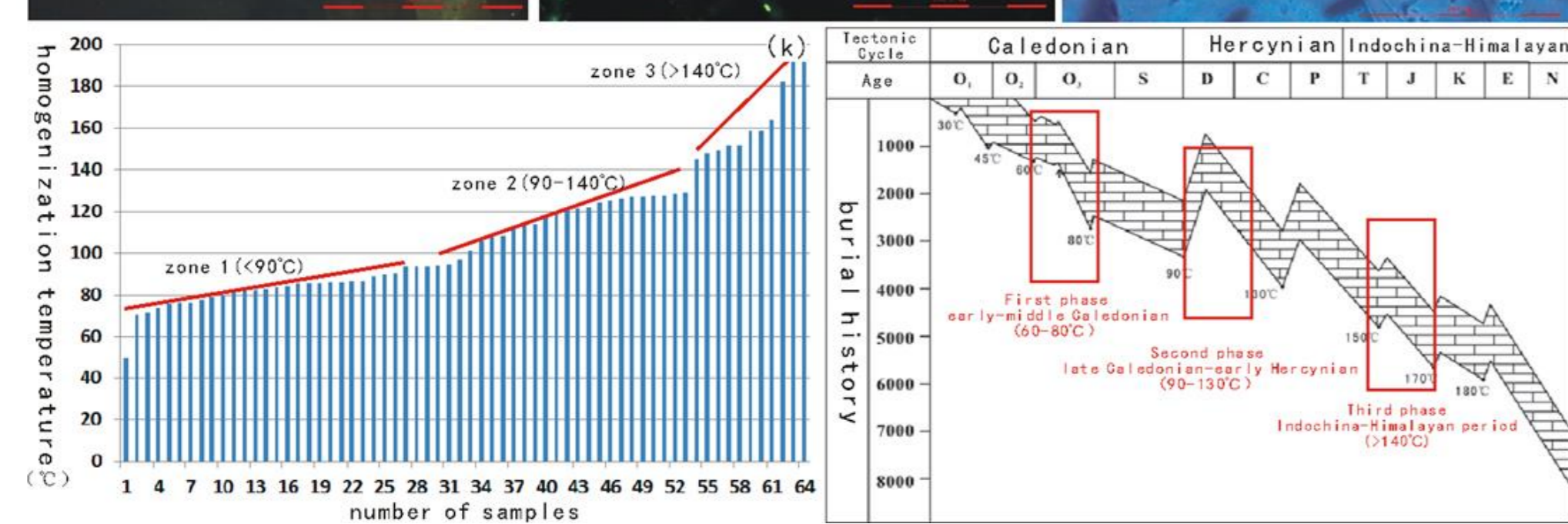
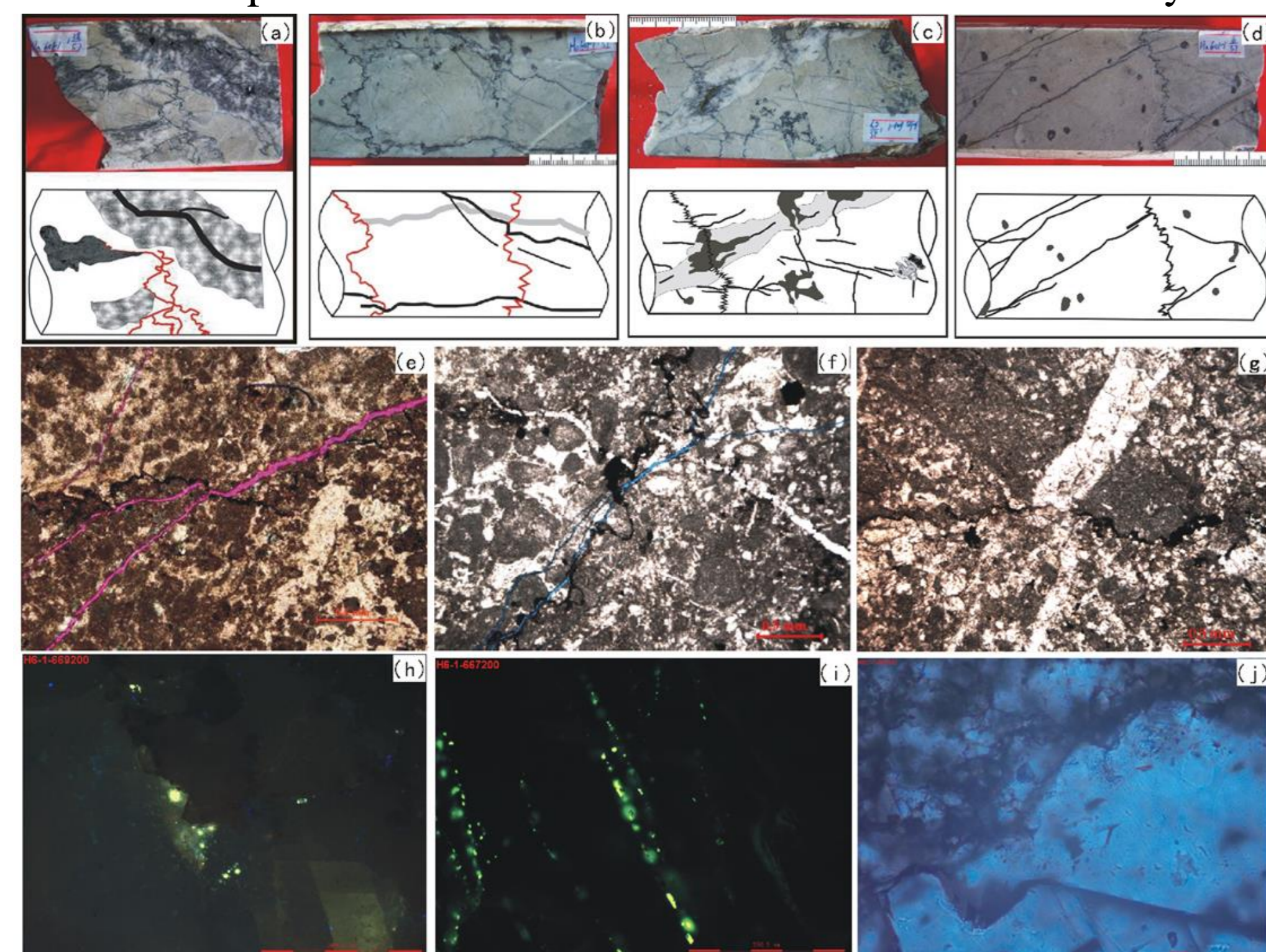


Fig.3 The analysis of fracture stage in the cores and casting lamella

## 2. DATA AND METHOD

- Well logs from 31 wells.
- The length of core is 33.5m.
- Imaging logging from 20 wells.
- Carbon and oxygen isotope from 85 samples and more than 32 samples of casting thin sections.
- We first got definite conclusion that 3 issues of structural fractures and 2 issues of strike-slip fault, and then concluded karst fluid is meteoric water.
- We subdivided five types of fracture-cavity reservoir controlled by two phases of strike-slip faults.

### 3.3 Control effect of faults

- The faults developed in middle Caledonian can act as the water inlet for tubulose underground river
- The faults and Lianglitage surface river is the key factors which controls caves' development. the vertical scale of this cave is much bigger than its horizontal scale(such as doline caves).
- In the period of late Caledonian to early Hercynian, new faults appeared again. At this time, the main effect of faults is provide water inlet and accelerate the fracture development. This cave developed along the faults.
- The fractures which developed in middle Caledonian and late Caledonian to early Hercynian has the feature of low filling degree and bigger scale.

### 3.4 Modeling of caves

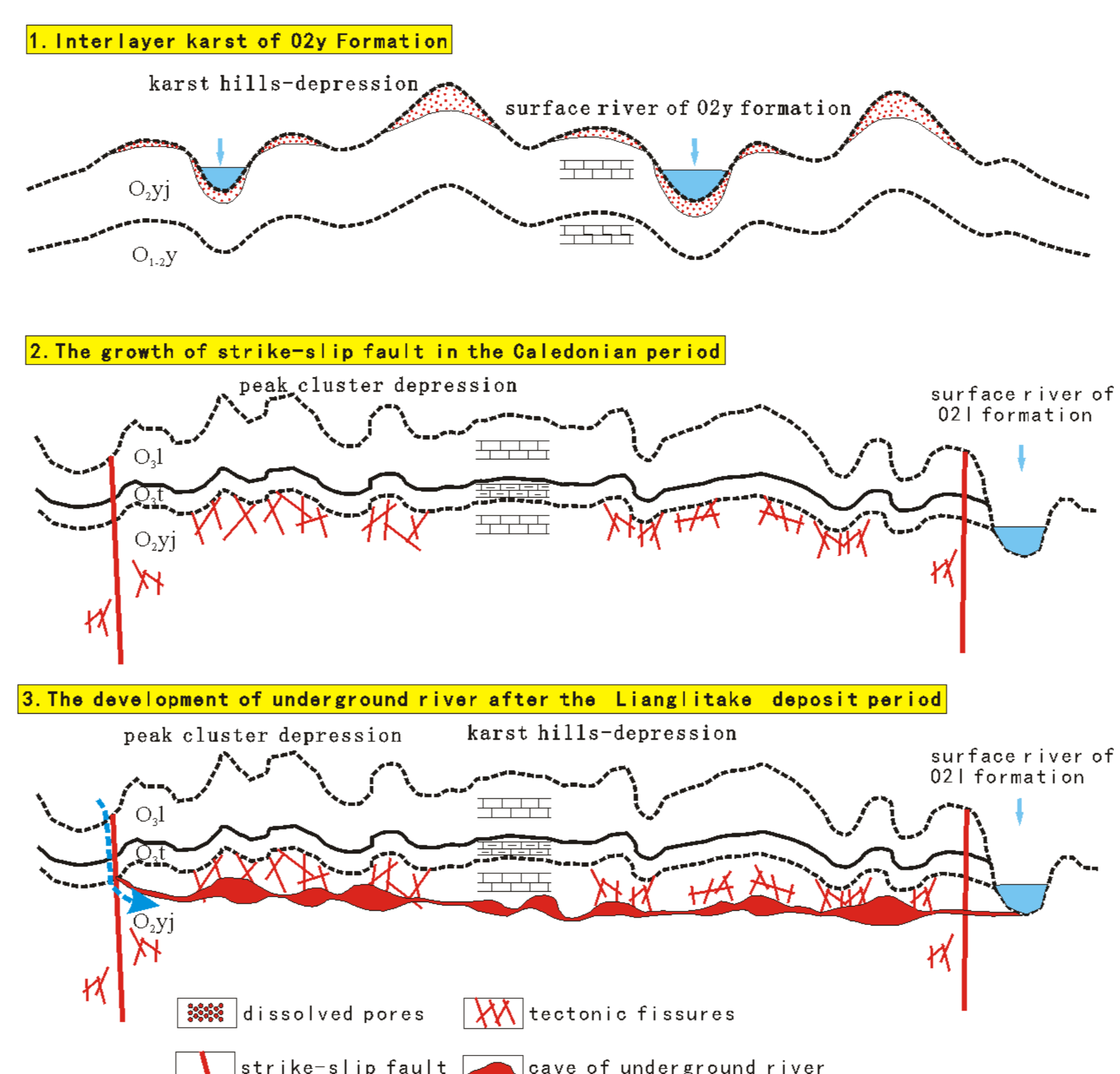


Fig.6 The evolution of tubulose underground river controlled by faults

## 4. CONCLUSIONS

- The influence of the faults to karst in interlayer karst area in Halahatang break the ordinary theory of zonation of weathering and buried hill karst. The fracture-vuggy systems in Yijiangfang Formation could be divided as the fracture-cavity zone and cave zone, and their development is barely influenced by water table.
- The fault-river controlled caves is mostly influenced by ancestral rivers in Lianglitag Formation, their scale is large in vertical and the connectivity is good; fault controlled caves are formed by dissolution of earlier fracture-cavity system controlled by late Caledon-early Hercynian faults.

## 5. ACKNOWLEDGEMENT

This work is supported by National Key Basic Research Program (973) (2011CB201003) and National Science and Technology Key Project (2011ZX05014-002).

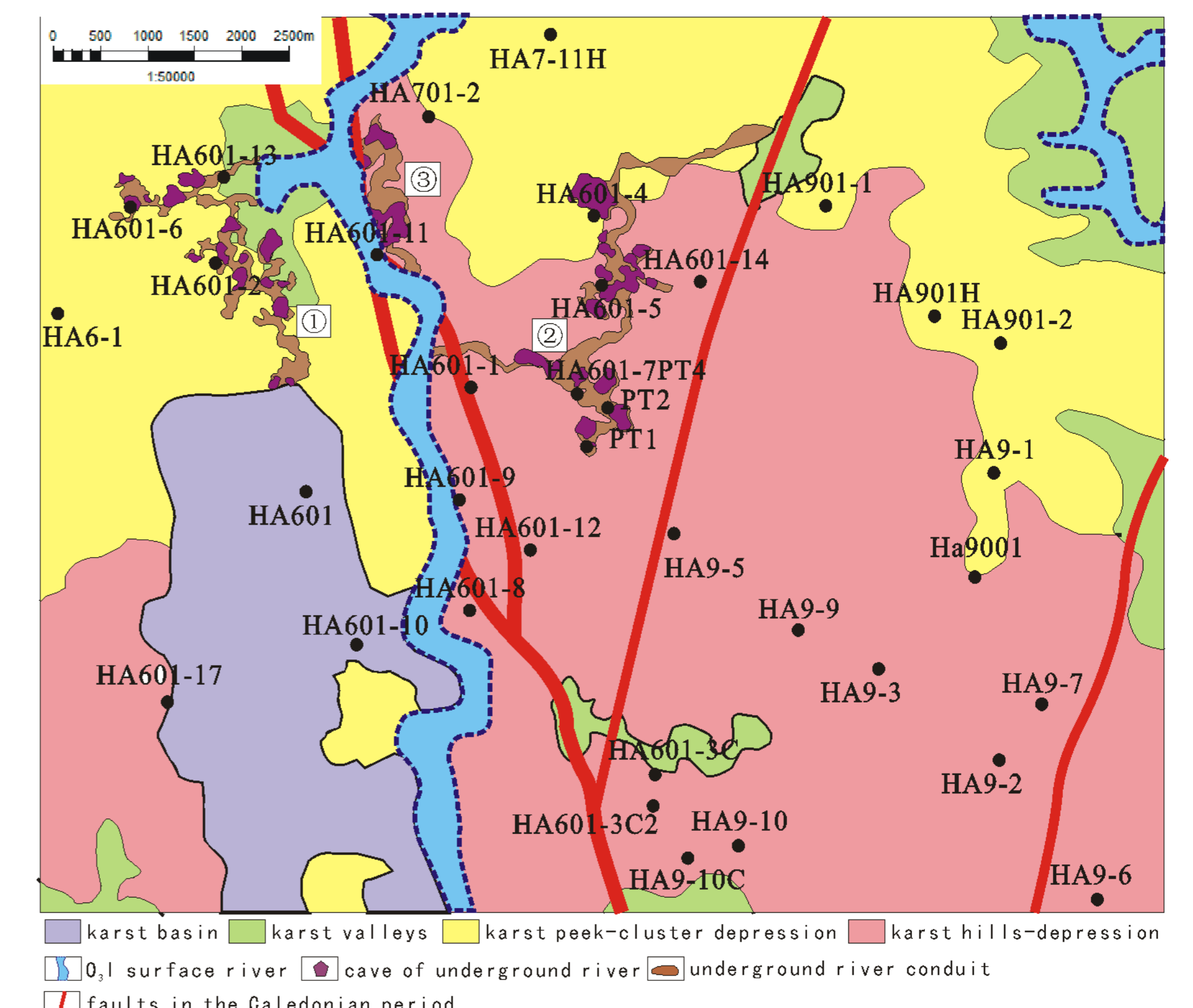


Fig.4 The development position of tubulose underground river and paleotopography of Lianglitage formation

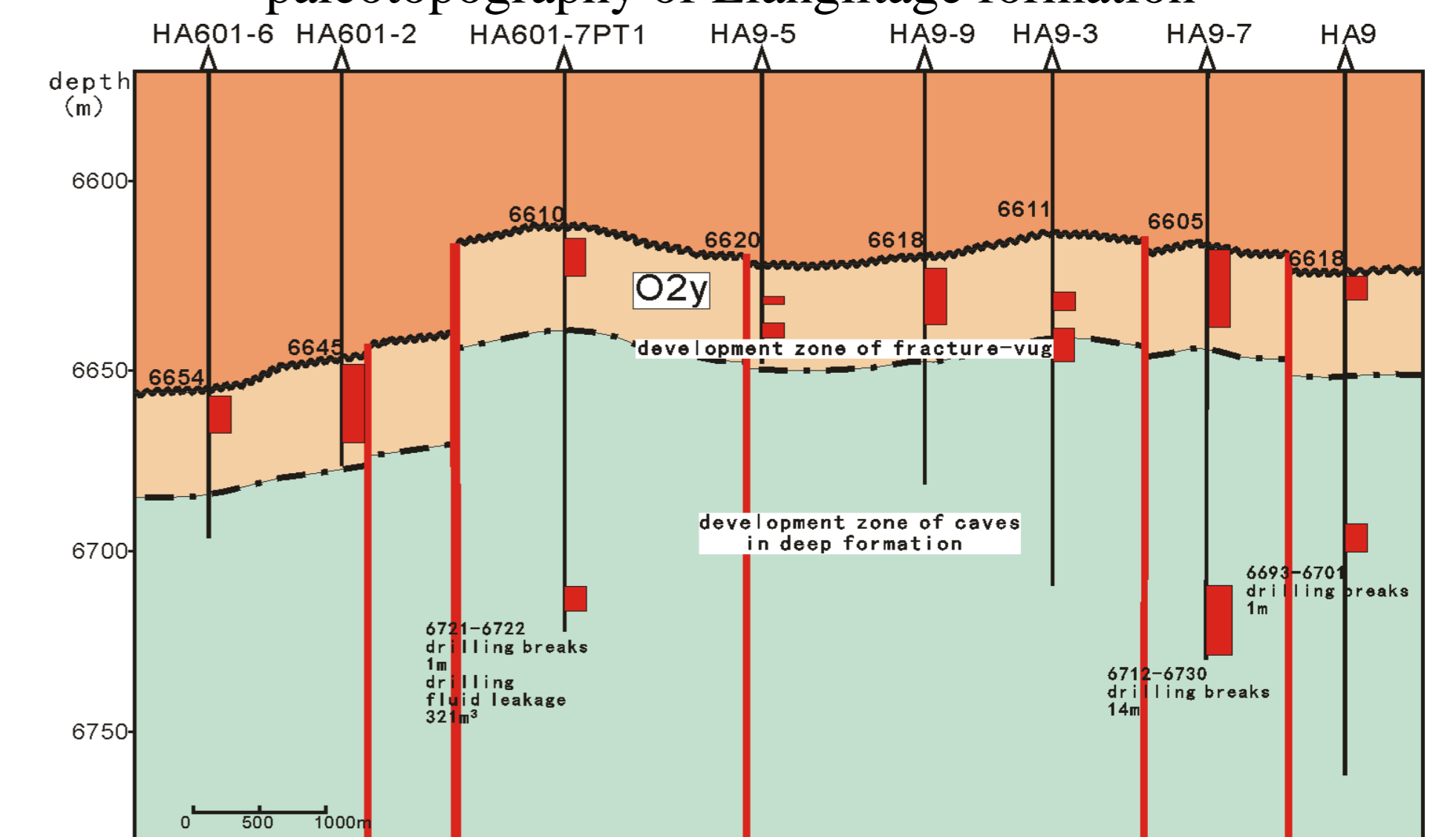


Fig.5 Vertical section of Ordovician karst zone in HA601 wellblock

Faults in middle Caledonian controlled the the caves of underground river and doline caves' development. They has three major stages, including faults development in middle Caledonian, undercutting of the rivers in Lianglitage Formation, and faults development in late Caledonian to early Hercynian.

Faults in late Caledonian to early Hercynian controlled the distribution of discrete caves. All the structural fractures are associated with the faults. Fracture in the first phase and second phase has the effectiveness in reservoir development.