PROPOSED MODIFICATIONS OF THE INTERNATIONAL STANDARD LEGEND FOR LARGE SCALE HYDROGEOLOGICAL MAPS IN CARBONATE ROCKS

Gheorghe Ponta

www.karstgeology.com

gponta@karstgeology.com

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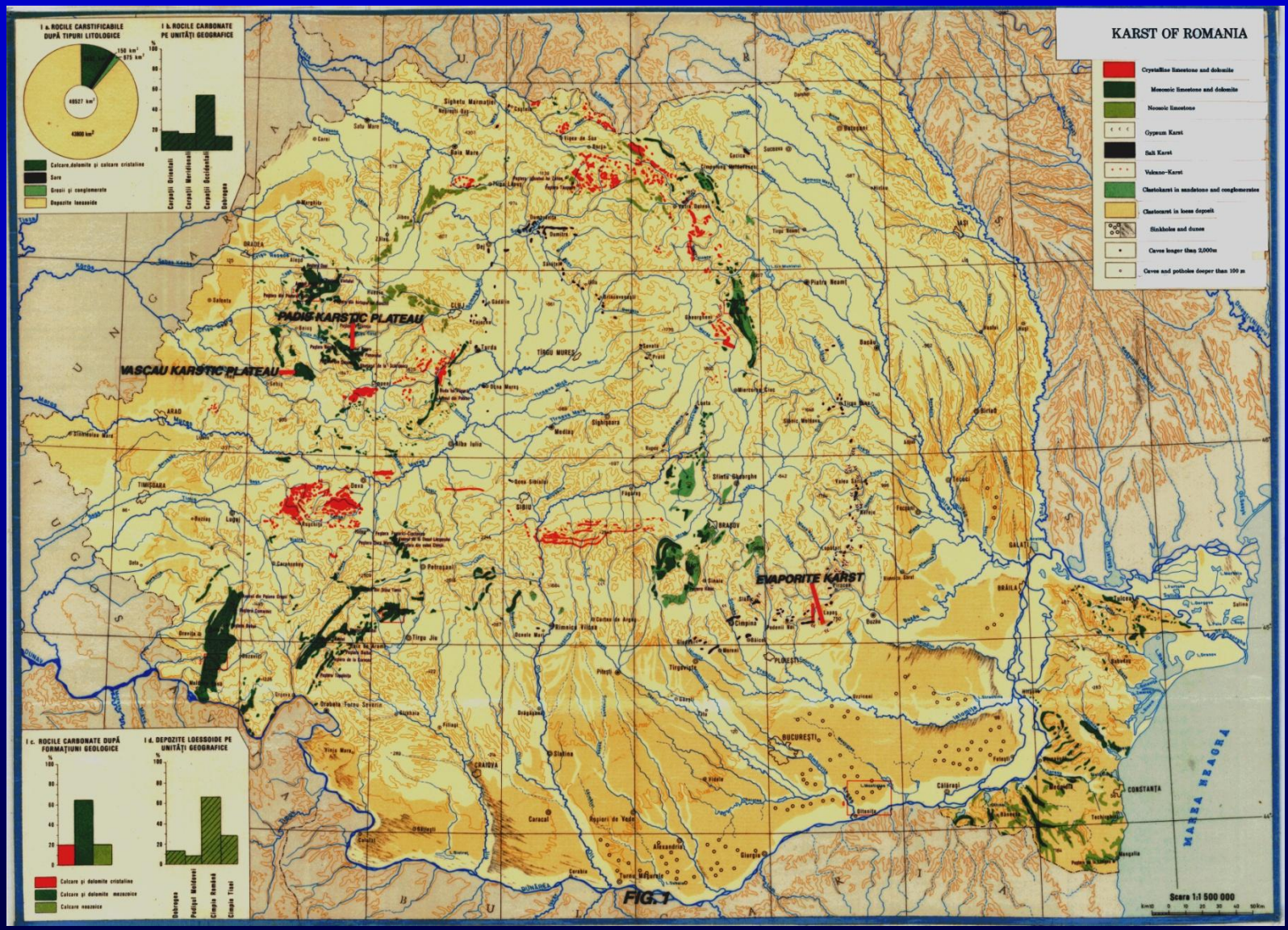
KARST OF ROMANIA

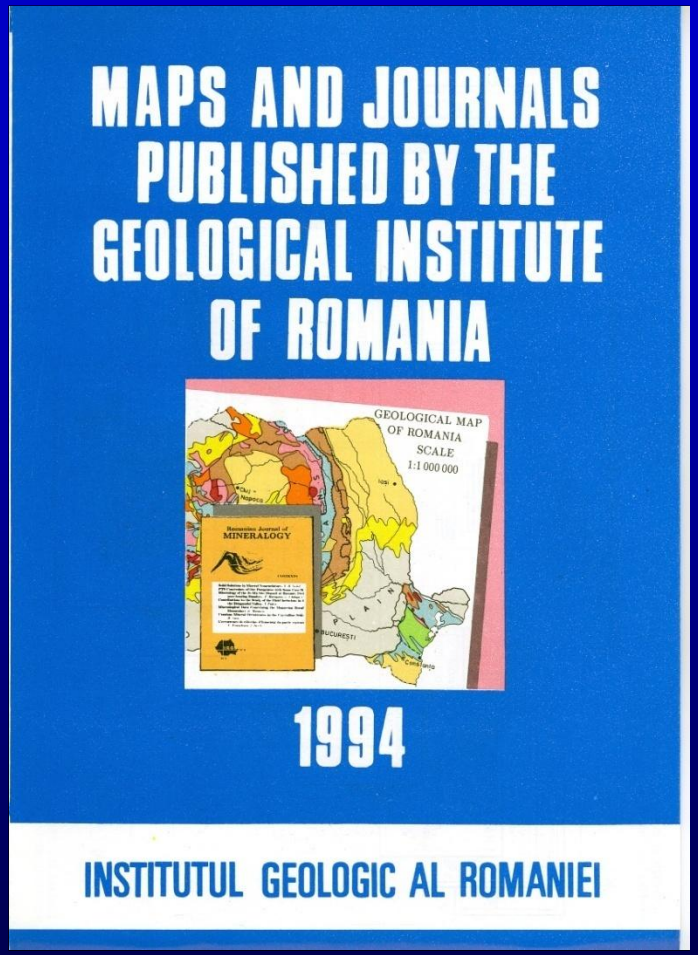
- Romania has 237,500 km^2 (91,671 sq. miles) of which 4,400 km^2 is karst (1.4%)
- 65% of karst is developed in Mesozoic deposits
- 12,000 caves (a cave is a horizontal or vertical cavity, at least 5 meters long)
- Total length over 400 km of passages recorded

KARST OF ROMANIA



VASCAU HYDROGEOLOGICAL MAP

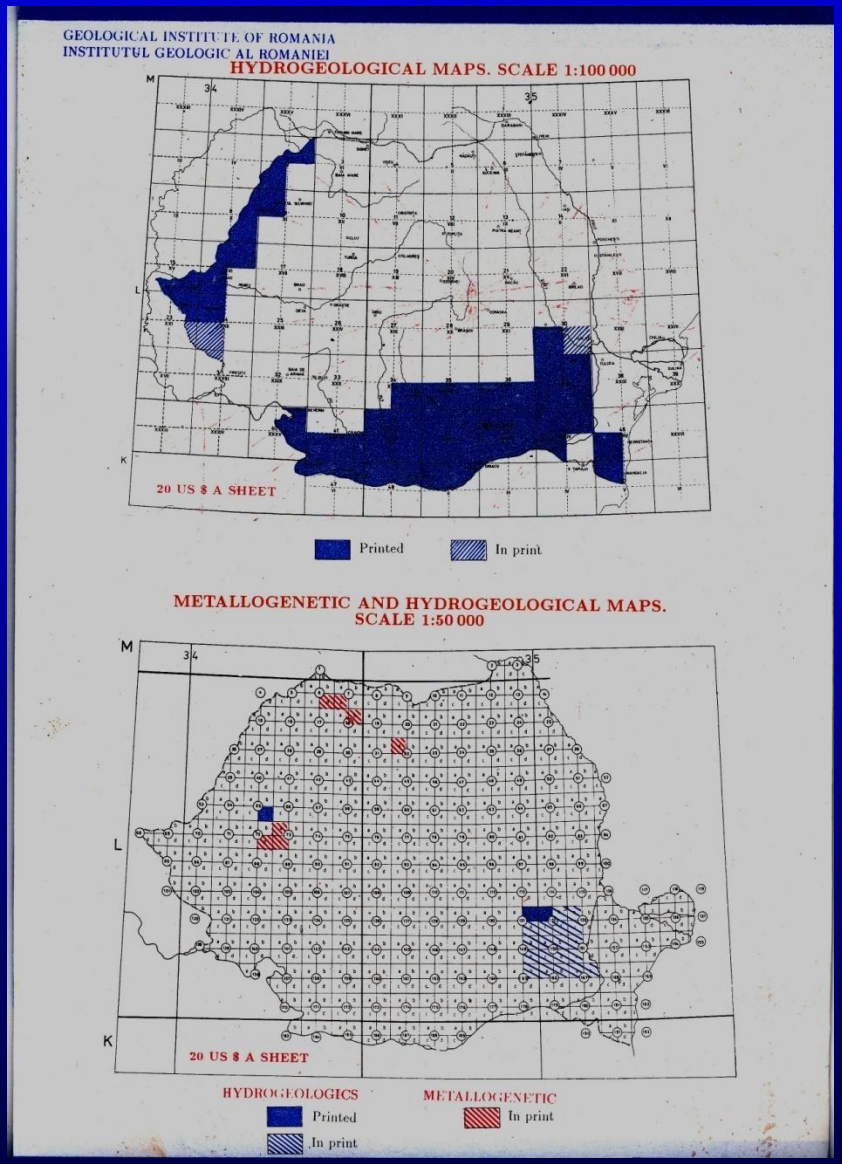
In the second part of the last century, The Geological Institute of Romania, developed geological, (1:50,000) and hydrogeological (1:100,000) mapping programs

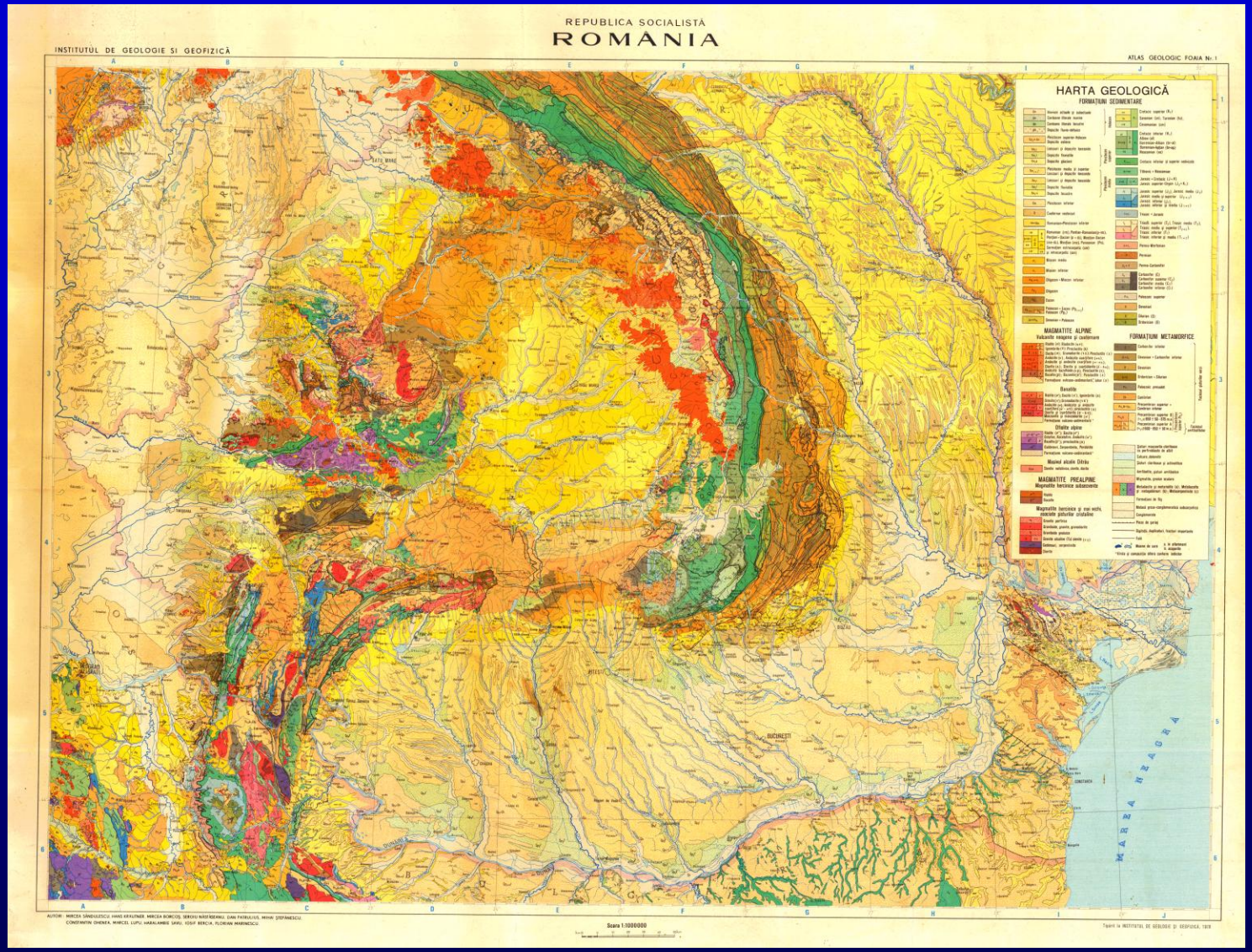


VASCAU HYDROGEOLOGICAL MAP

In 1980s the hydrogeological maps (scale 1:100,000) were completed in most of the plains of Romania.

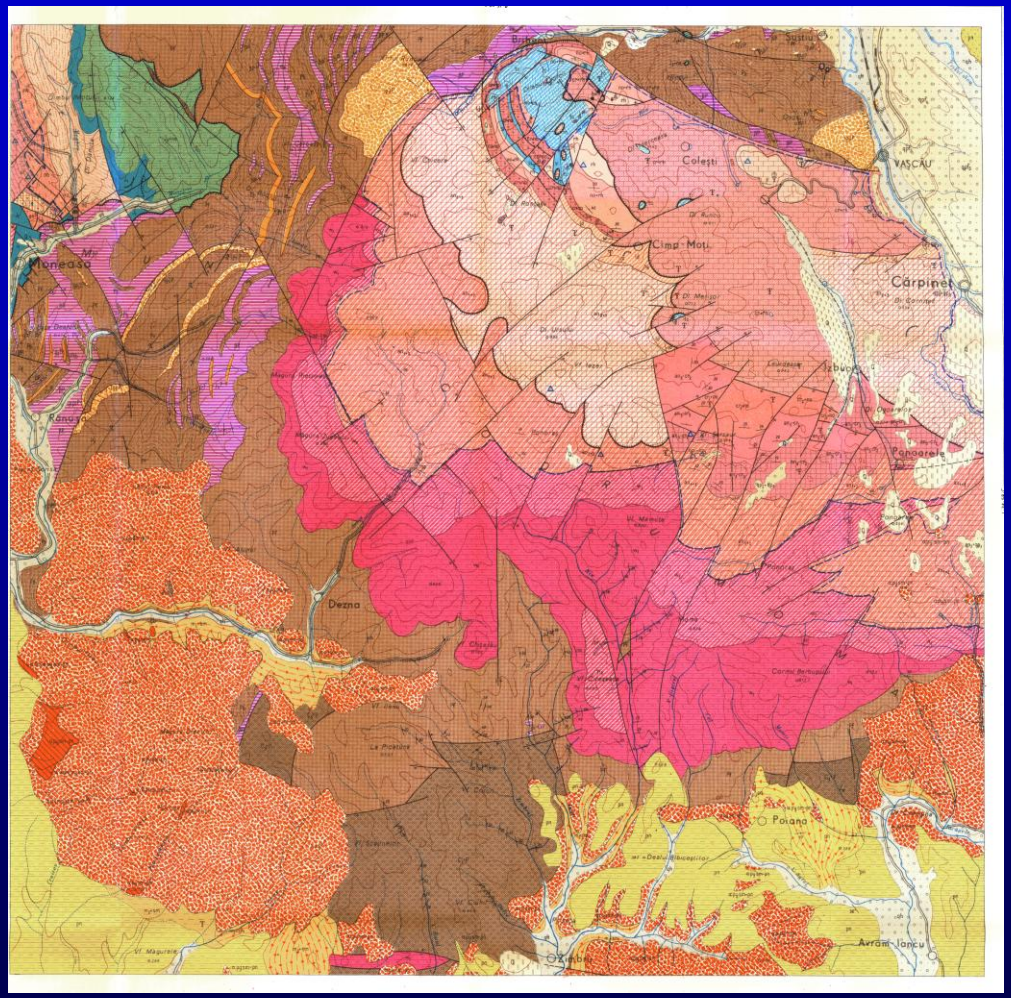
The next step was to move toward the Carpathian Mountains.





Due the complex geology of the Carpathians, the hydrogeological maps in the karst areas were finalized at a scale of 1:50,000.

VASCAU GEOLOGICAL MAP



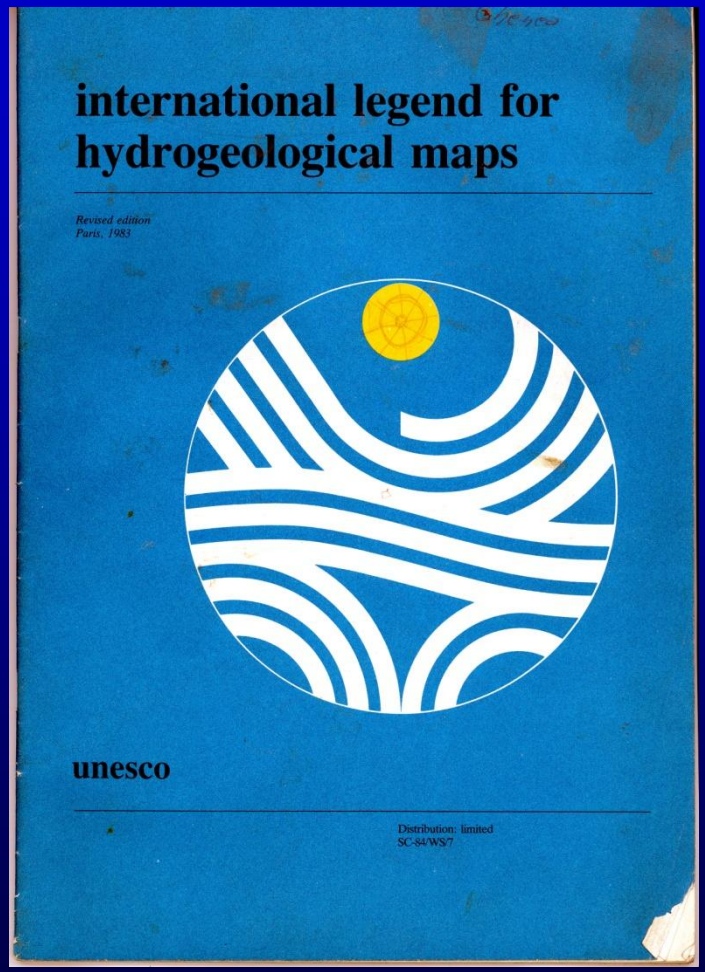
To start with we had:

- Vascau sheet geologic map (scale 1:50,000)
- Review of hydrogeological reports, including dye studies and climatic water balance for the area
- Karst features identified on topographic maps and air photos (scale 1:5,000)
- Where necessary, additional dye studies were performed

VASCAU HYDROGEOLOGICAL MAP

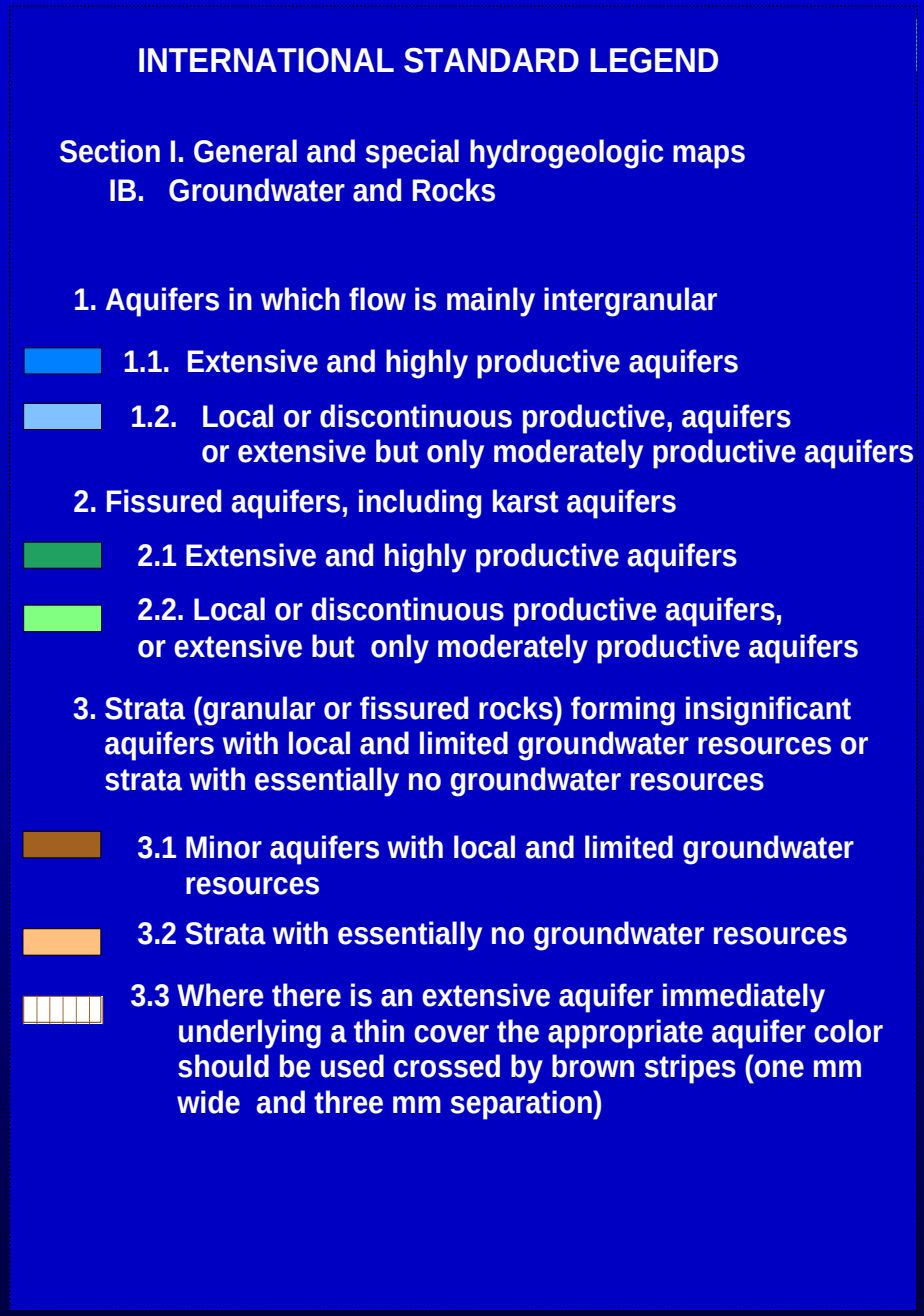
In the mid-eighties, the IAH Commission on Hydrogeological Maps, in cooperation with IAHS and UNESCO, prepared a revised edition of the *International Standard Legend for Hydrogeological Maps (ISLHM),* published as a UNESCO technical paper in *Hydrology* (ANON, 1983).

The modified version of the legend was used to complete the Romanian Hydrogeological Mapping program for karstic terrain (scale 1:50,000).



VASCAU HYDROGEOLOGICAL MAP

In *The International Standard Legend for General and Special Hydrogeological Maps*, the "*Groundwater and Rocks*" category was subdivided into three main categories, with karst included in "Fissured aquifers, including karst aquifers"



VASCAU HYDROGEOLOGIC MAP

INTERNATIONAL STANDARD LEGEND (MODIFIED)

Section I. General and special hydrogeologic maps
IB. Groundwater and Rocks

1. Aquifers in which flow is mainly intergranular

1.1. Extensive and highly productive aquifers

1.2. Local or discontinuous productive, aquifers or extensive but only moderately productive aquifers

2. Groundwater in karst aquifers

2.1. Highly productive karst aquifers

2.2. Moderately productive karst aquifers

2.3. Local and discontinuos karst aquifers

3. Fissured aquifers

3.1 Extensive and highly productive aquifers

3.2. Local or discontinuous productive aquifers, or extensive but only moderately productive aquifers

4. Strata (granular or fissured rocks) forming insignificant aquifers with local and limited groundwater resources or strata with essentially no groundwater resources

4.1 Minor aquifers with local and limited groundwater resources

4.2 Strata with essentially no groundwater resources

4.3 Where there is an extensive aquifer immediately underlying a thin cover the appropriate aquifer color should be used crossed by brown stripes (one mm wide and three mm separation)

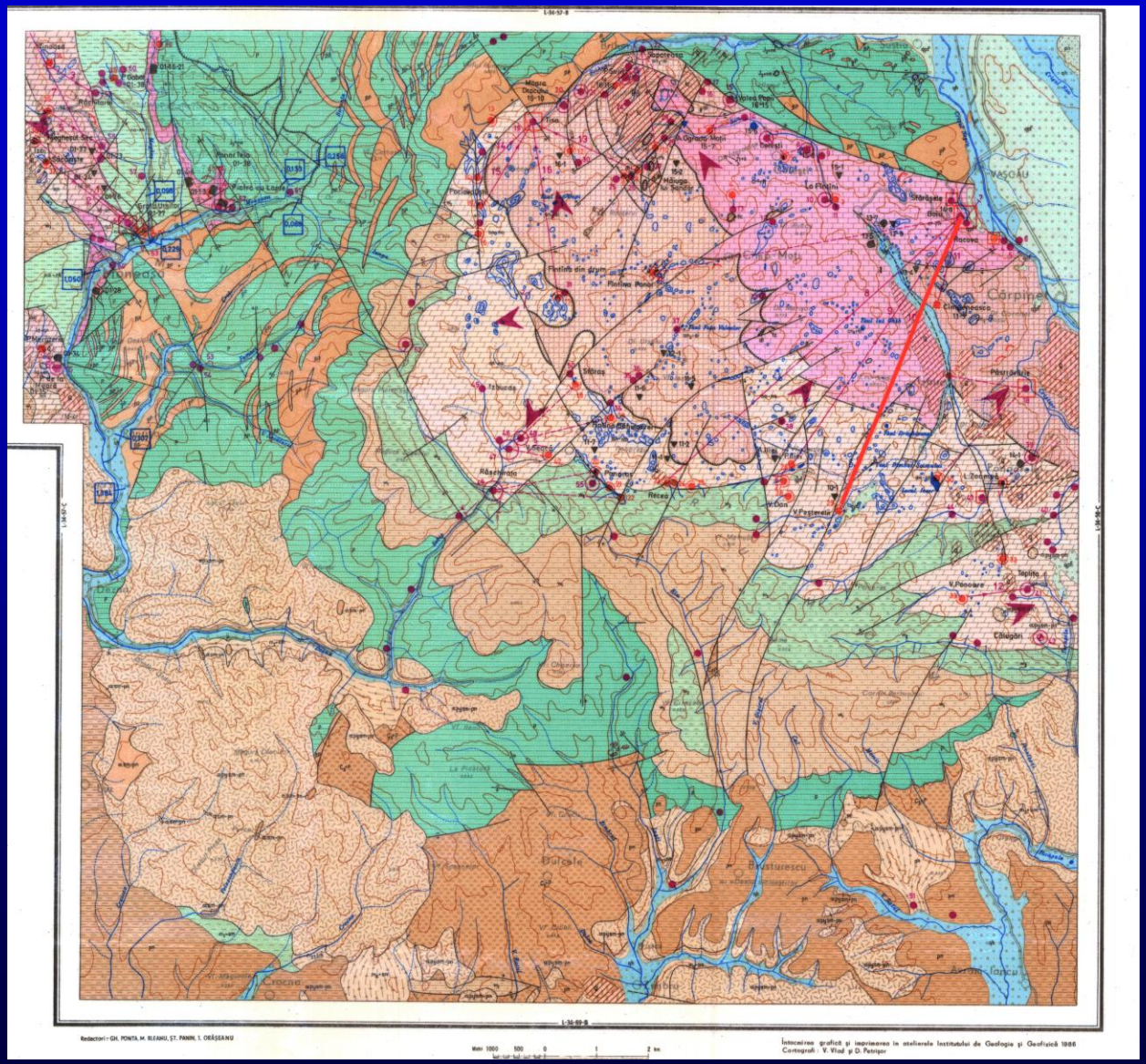
Because of the large variation in the development of karst features, and the volume of data related to ground/surface water in karst areas in Romania, data were presented on the map as a subcategory of “Groundwater and Rocks”, using a range of pink colors to differentiate aquifers in karstic terrain, versus the traditional range of green colors, used to represent the fissured non-karstic/karstic rocks

VASCAU HYDROGEOLOGIC MAP

The hydrogeologic map includes information on:

- aquifer geometry (geology, cave exploration)
- permeability
- hydraulic regime (spring and sinking stream discharge, river mean annual runoff, dye studies)

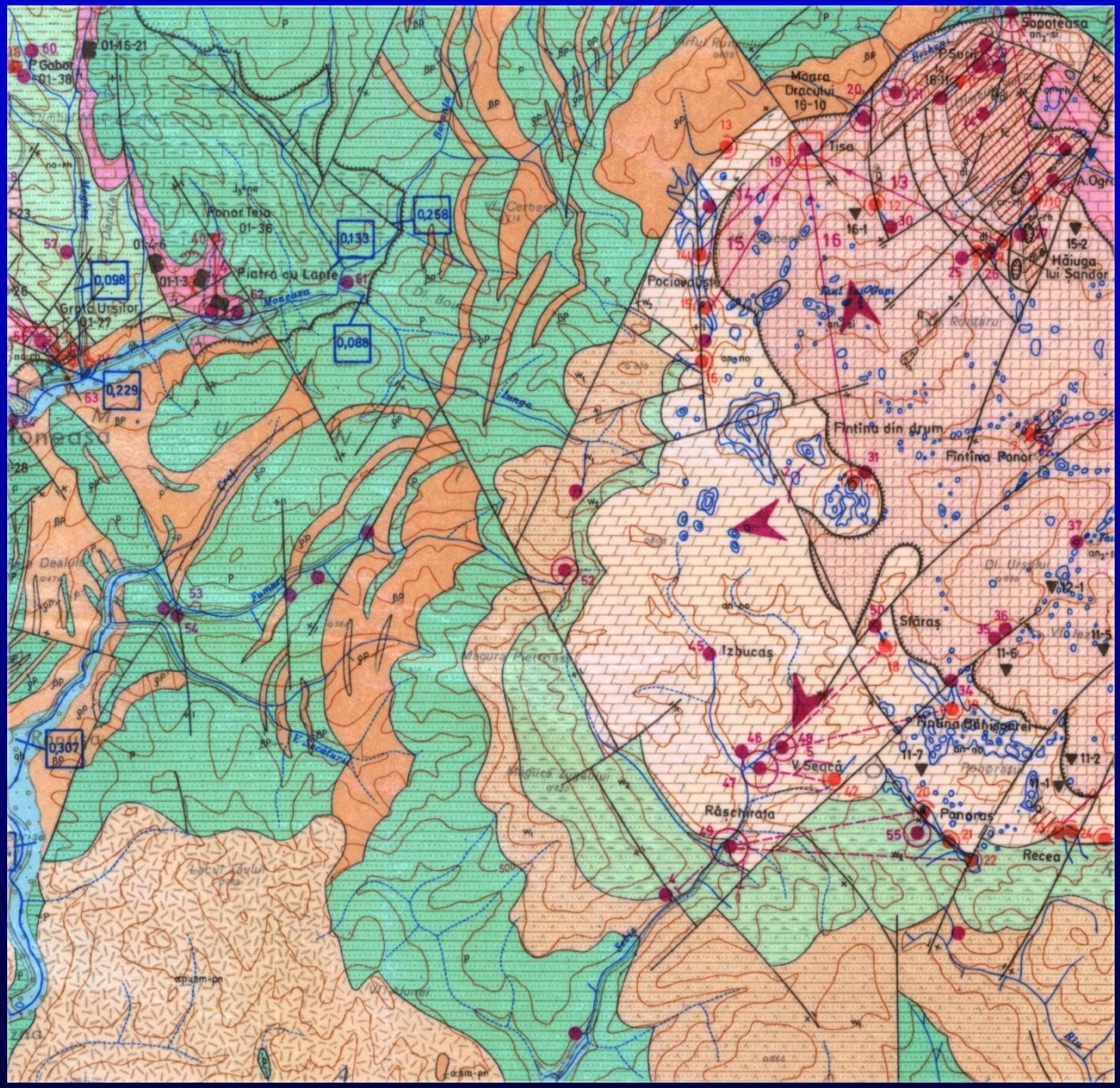
VASCAU HYDROGEOLOGIC MAP



VASCAU HYDROGEOLOGIC MAP

In the non-karstic areas, the majority of the springs are located at the intersection of faults/joints

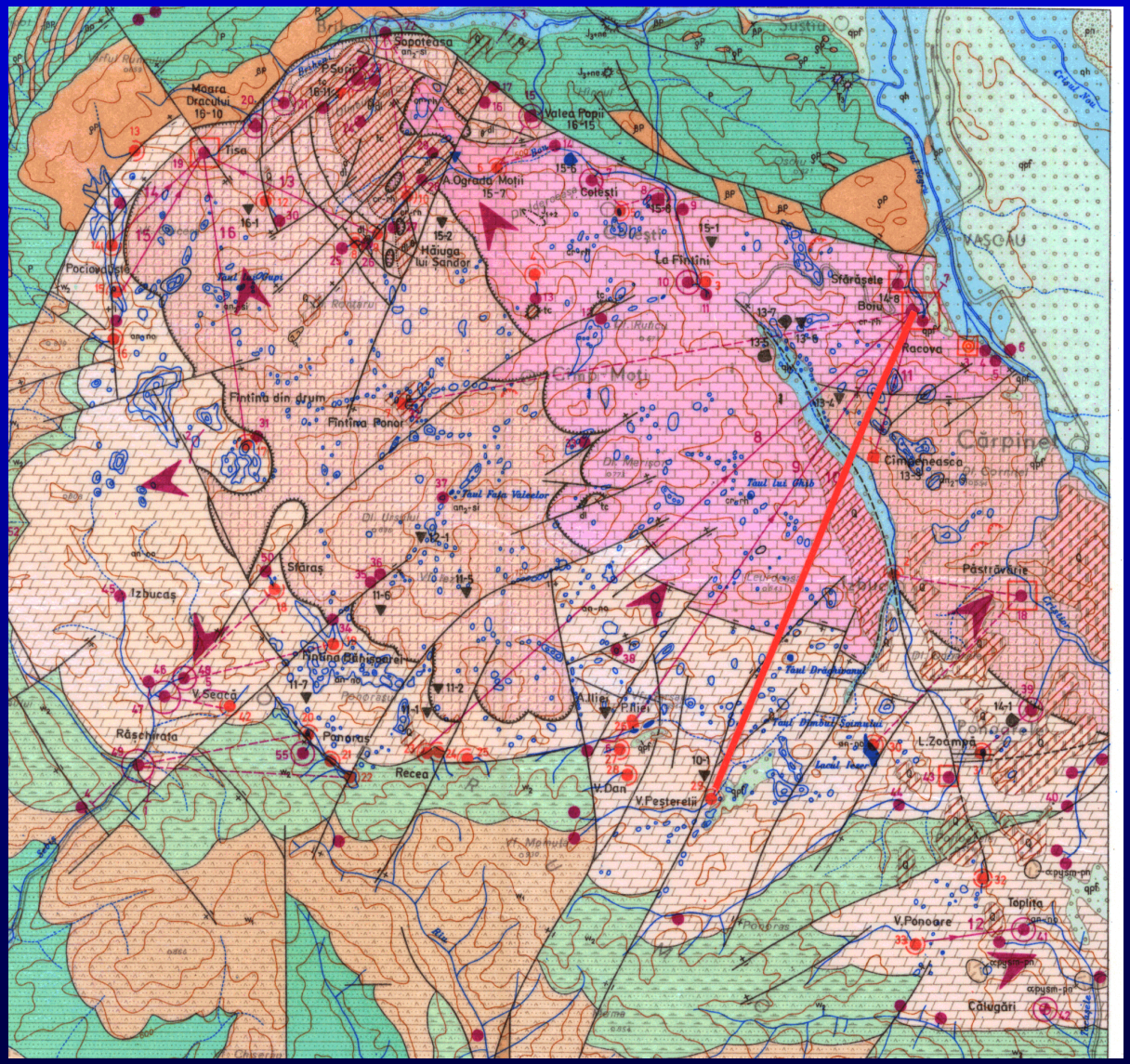
VASCAU HYDROGEOLOGIC MAP



VASCAU HYDROGEOLOGICAL MAP

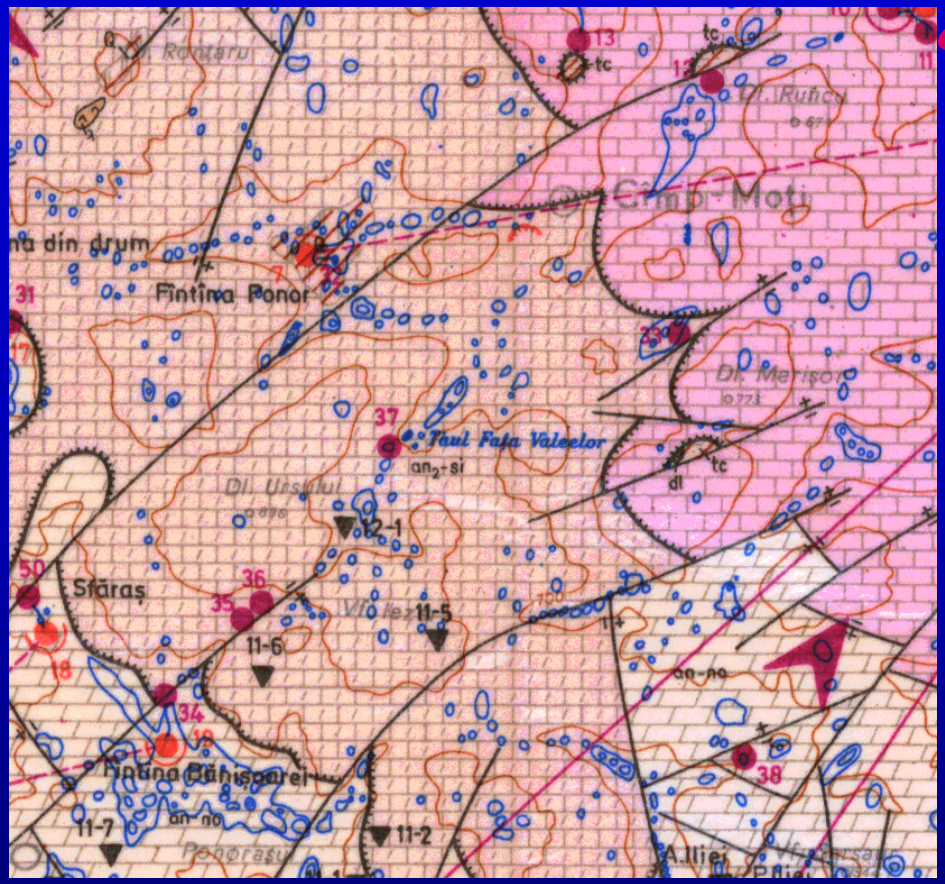
- Ranges of pink were used for different karst aquifers divided based on geology and secondary porosity
- Blue was used for hydrogeological features, including sinkholes (dolinas)

VASCAU HYDROGEOLOGICAL MAP



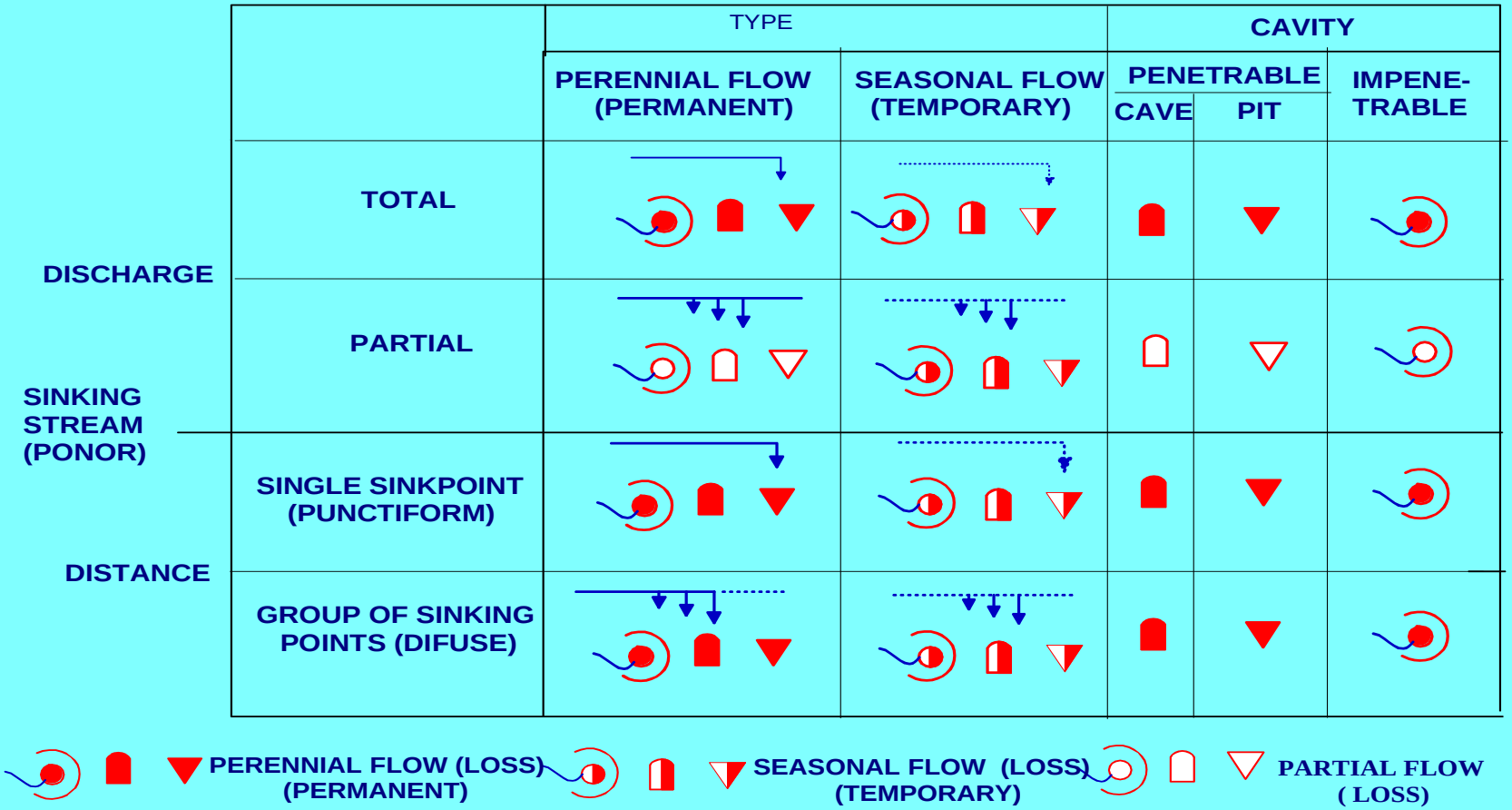
VASCAU HYDROGEOLOGICAL MAP

- Main faults defined by geologic mapping matched the sinkhole alignments
- In some places, the faults can be extended based on the sinkhole alignments recorded during karst inventory



VASCAU HYDROGEOLOGICAL MAP

SINKING STREAMS (PONOR) SYMBOLS USED ON LARGE SCALE HYDRGEOLOGICAL MAPS IN ROMANIA

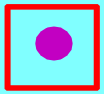
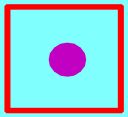


VASCAU HYDROGEOLOGICAL MAP

SINKING STREAMS

VASCAU HYDROGEOLOGICAL MAP

SPRINGS SYMBOLS USED ON LARGE SCALE HYDRGEOLOGICAL MAPS IN ROMANIA

SPRINGS CLASSIFIED AFTER AVERAGE DISCHARGE				
	LESS 1 L/S	1 - 10L/S	10 - 100 L/S	OVER 100 L/S
SPRING				
PUMPING STATION FROM SPRING				
INTERMMITENT SPRING				
THERMAL SPRING				
WATER WELL				

VASCAU HYDROGEOLOGICAL MAP

KARST SURFACE SYMBOLS USED ON LARGE SCALE HYDRGEOLOGICAL MAPS IN ROMANIA

	FOSSIL	SINKING STREAM	SPRING	UNDERGROUND RIVER INTERCEPTED
CAVE				
PIT (AVEN)				

SINKHOLE (DOLINA)

CLOSED DEPRESSIONS (UVALA)

VASCAU HYDROGEOLOGIAL MAP

- This legend was used and developed to meet the requirements of the Romanian Hydrogeological maps program in karstic terrain
- Two years of work per map was necessary
- Currently five hydrogeological maps (scale 1:50,000) have been finalized, based on this legend

THANK YOU!!