SPRINGS DOCUMENTED IN “HISTORICAL” TOPOGRAPHIC MAPS: CREATION OF A DIGITALIZED DATABASE AND CONTRIBUTION TO A WEBSITE ON GROUNDWATER RESOURCES

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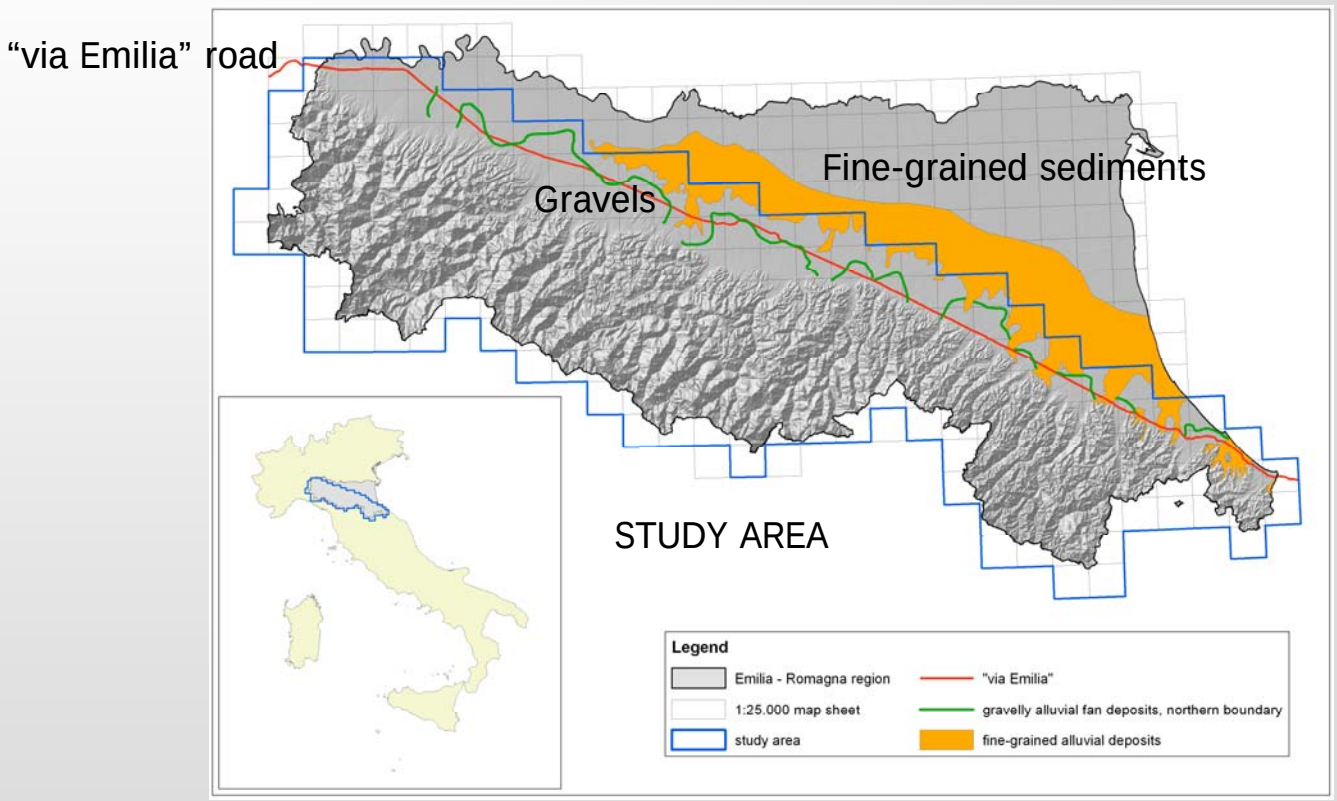
This project was set-up and developed by the “Istituto per i Beni Artistici, Culturali and Naturali” (IBC) and the “Servizio Geologico, Sismico e dei Suoli” (SGSS) of the Emilia-Romagna Region: an agreement between culture, history and hydrogeology.

Work steps

- study area and cartographic acquisition
- scanning and georeferencing
- digitalization
- results and web application

• study area and cartographic acquisition



• study area and cartographic acquisition

The Institute of Artistic, Cultural and Environmental Heritage of Emilia-Romagna Region (IBC) provided the maps.

These were compiled around the **'30s** and later updated.

Some of these (30) belong to a different series, given that the reference ellipsoid used was **Bessell** rather than **Hayford**.

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• scanning and georeferencing

The Scanning process was carried out by CalComp – SCAN PLUS III 800t

Image resolution: 600 dpi,

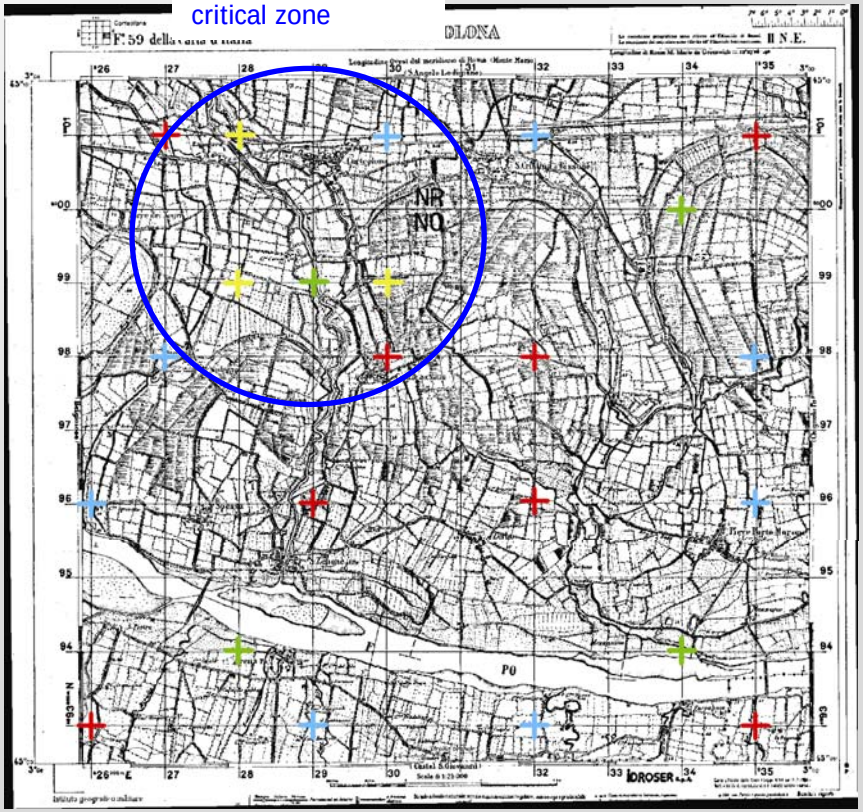
The reference system adopted is **UTMA-ED50**, which differs from the European cartographic system solely in the false northing equal to – 4.000.000,000000 m

• scanning and georeferencing

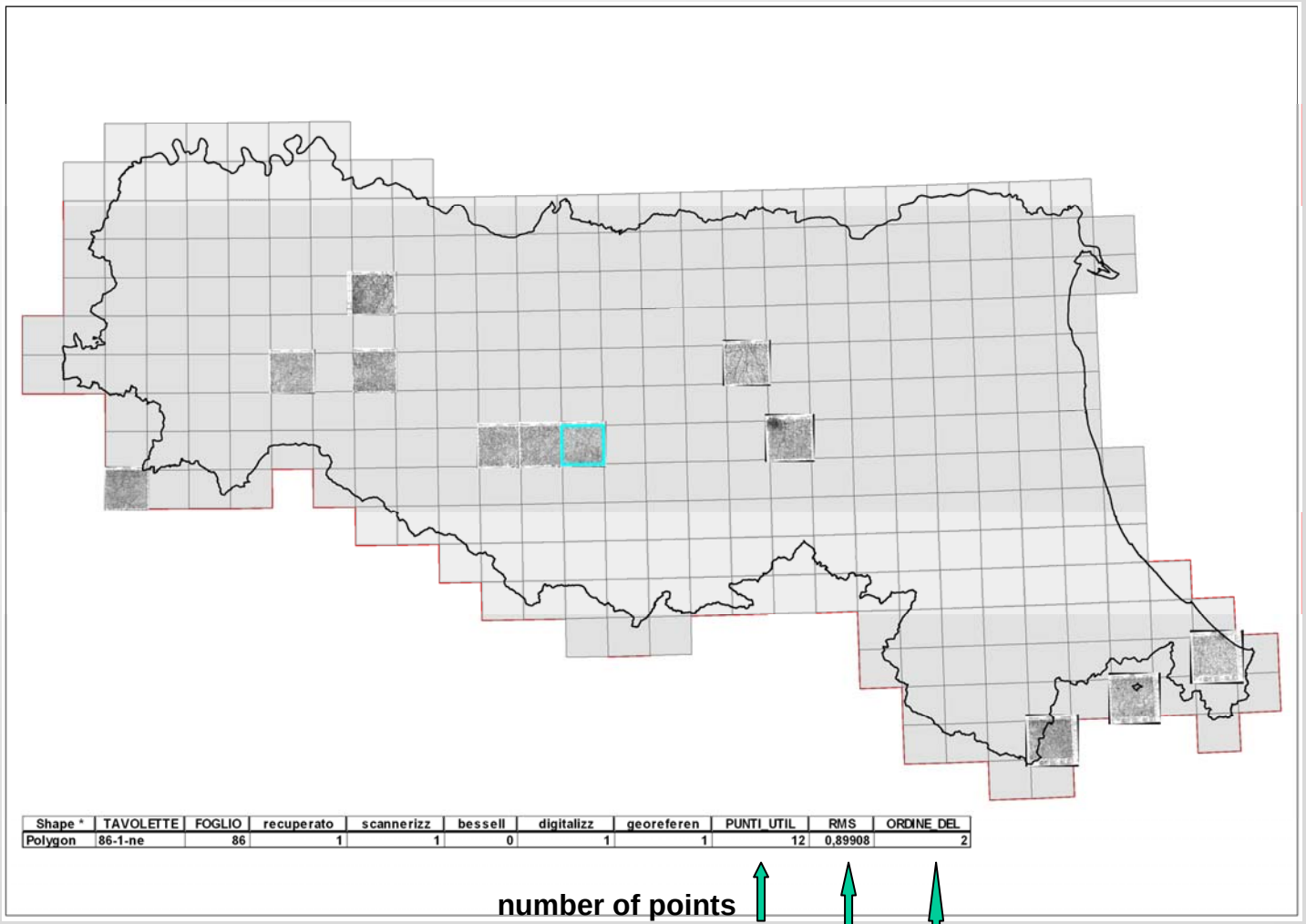
For each table, a minimum of **8** points were calculated, distributed evenly over the vertices of the kilometric grid

The number of points required for good georeferencing changed each time in accordance with image quality.

Sheet deformation: critical zone



- scanning and georeferencing



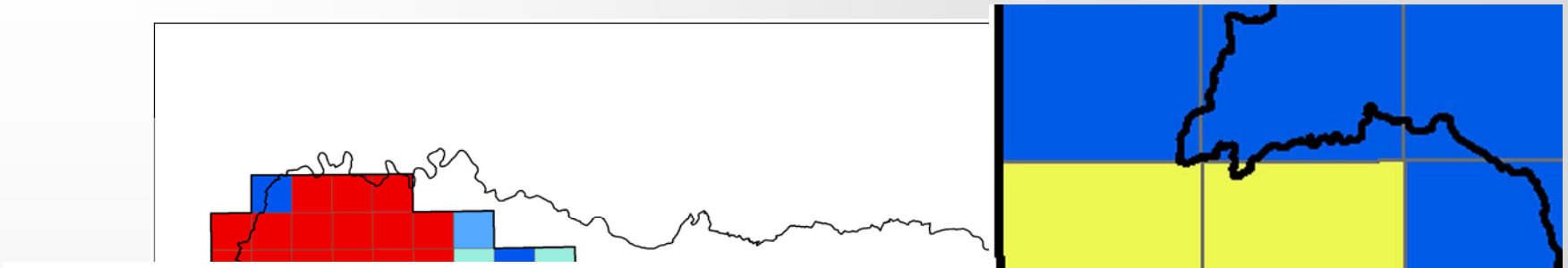
Shape *	TAVOLETTE	FOGLIO	recuperato	scannerizz	bessell	digitalizz	georeferen	PUNTI_UTIL	RMS	ORDINE_DEL
Polygon	86-1-ne	86	1	1	0	1	1	12	0,89908	2

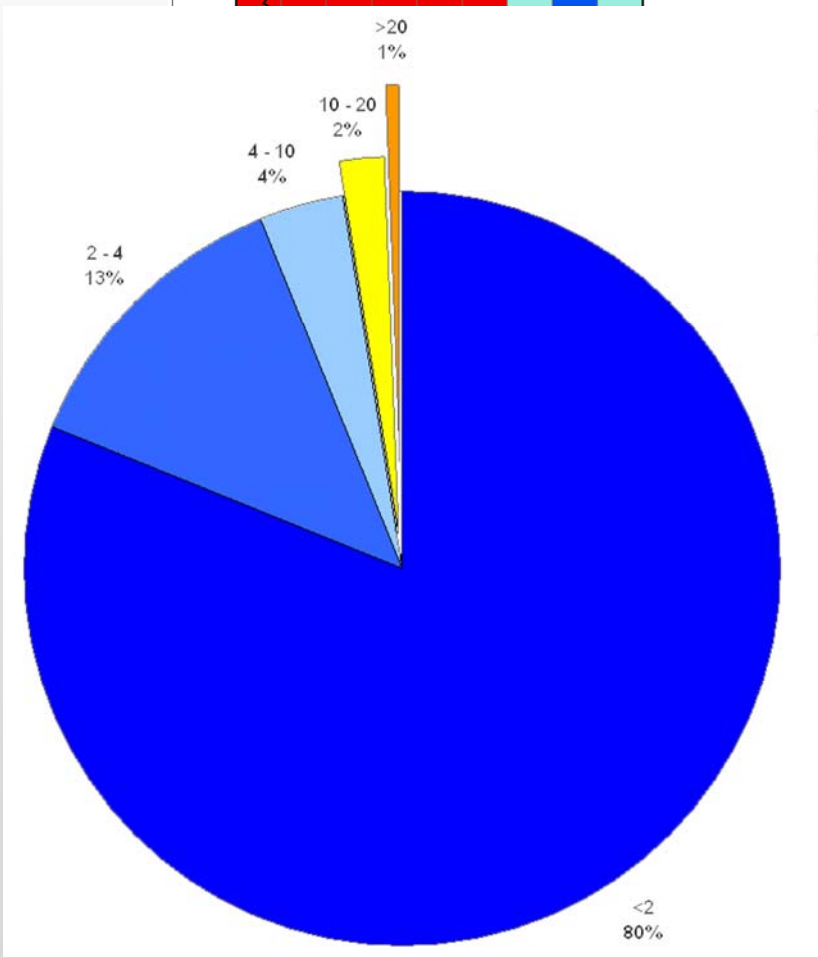
number of points

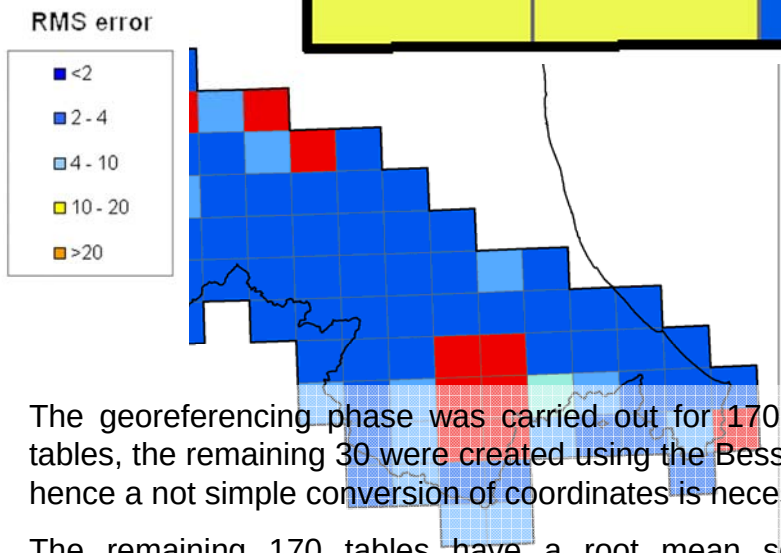
root mean square error

order of transformation

• scanning and georeferencing







The georeferencing phase was carried out for 170 of the 200 tables, the remaining 30 were created using the Bessell ellipsoid, hence a not simple conversion of coordinates is necessary.

The remaining 170 tables have a root mean square error categorized as follows (see pie chart diagram):

- **<2** [optimal error]: 134 tables, equal to about **80%**
- **2 – 4** [negligible error]: 21 tables, equal to about **13 %**
- **4 – 10** [not negligible error]: 6 tables, equal to about **4 %**
- **10 – 20** [significant error]: 3 tables, equal to about **2 %**
- **>20** [serious error]: 1 table, equal to about **1%**

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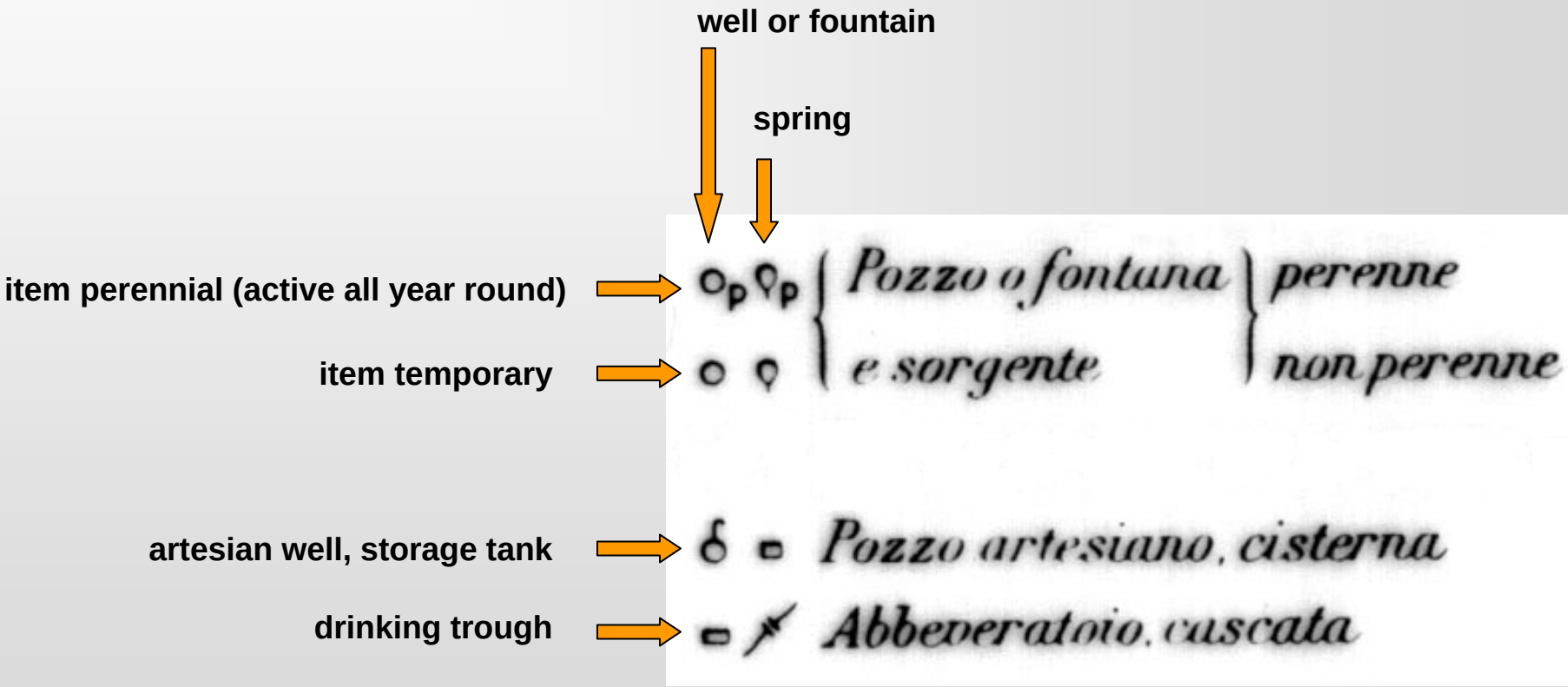
• digitalization

symbols visible on the historical map legend :



• digitalization

a table was compiled allowing for all the possible elements which would sooner or later have to be represented

Type

Represents the nature of the map element, identifying the following:

- spring
- well or fountain
- drinking trough
- storage tank
- uncertain spring

Perennial

Indicates whether the spring, well or fountain is perennial (active all year round) or temporary. This is represented in historical map with the letter “P”.

1: perennial

0: temporary

Place name

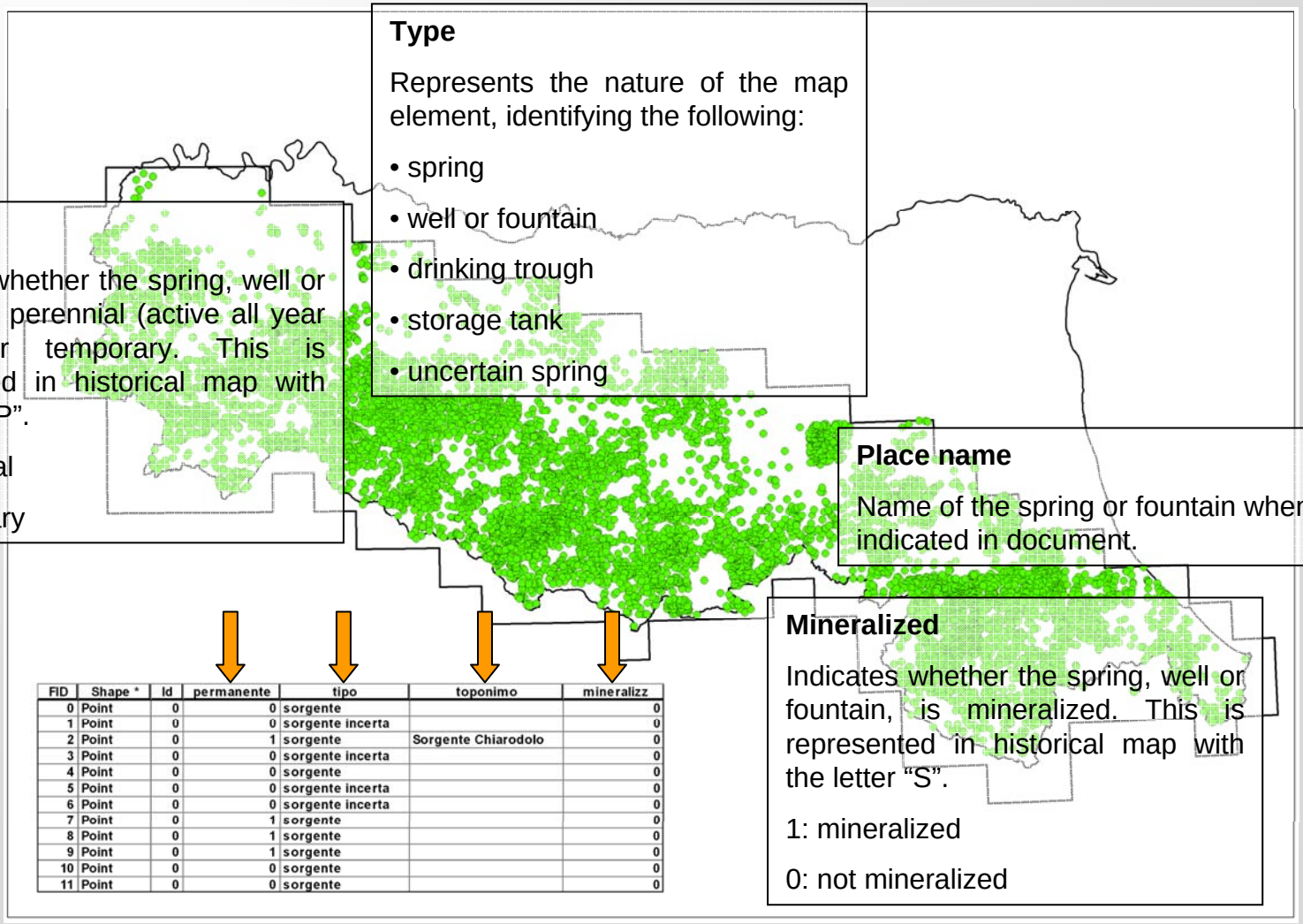
Name of the spring or fountain when indicated in document.

Mineralized

Indicates whether the spring, well or fountain, is mineralized. This is represented in historical map with the letter “S”.

1: mineralized

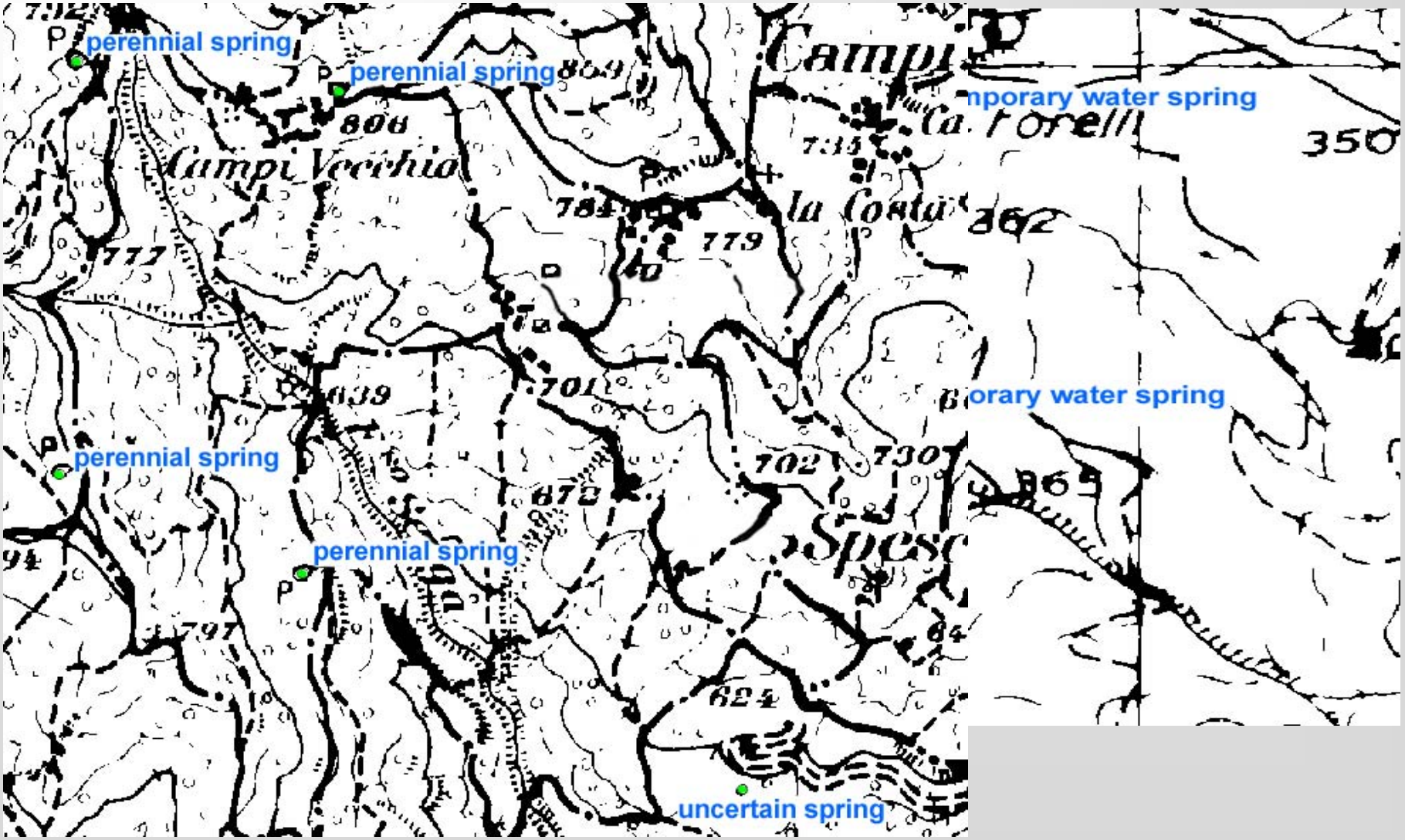
0: not mineralized



FID	Shape *	Id	permanente	tipo	toponimo	mineralizz
0	Point	0	0	sorgente		0
1	Point	0	0	sorgente incerta		0
2	Point	0	1	sorgente	Sorgente Chiarodolo	0
3	Point	0	0	sorgente incerta		0
4	Point	0	0	sorgente		0
5	Point	0	0	sorgente incerta		0
6	Point	0	0	sorgente incerta		0
7	Point	0	1	sorgente		0
8	Point	0	1	sorgente		0
9	Point	0	1	sorgente		0
10	Point	0	0	sorgente		0
11	Point	0	0	sorgente		0

• digitalization

some example of symbols visible on the historical map:



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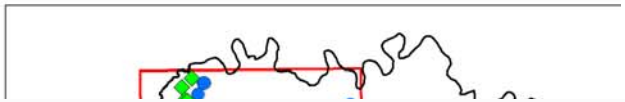
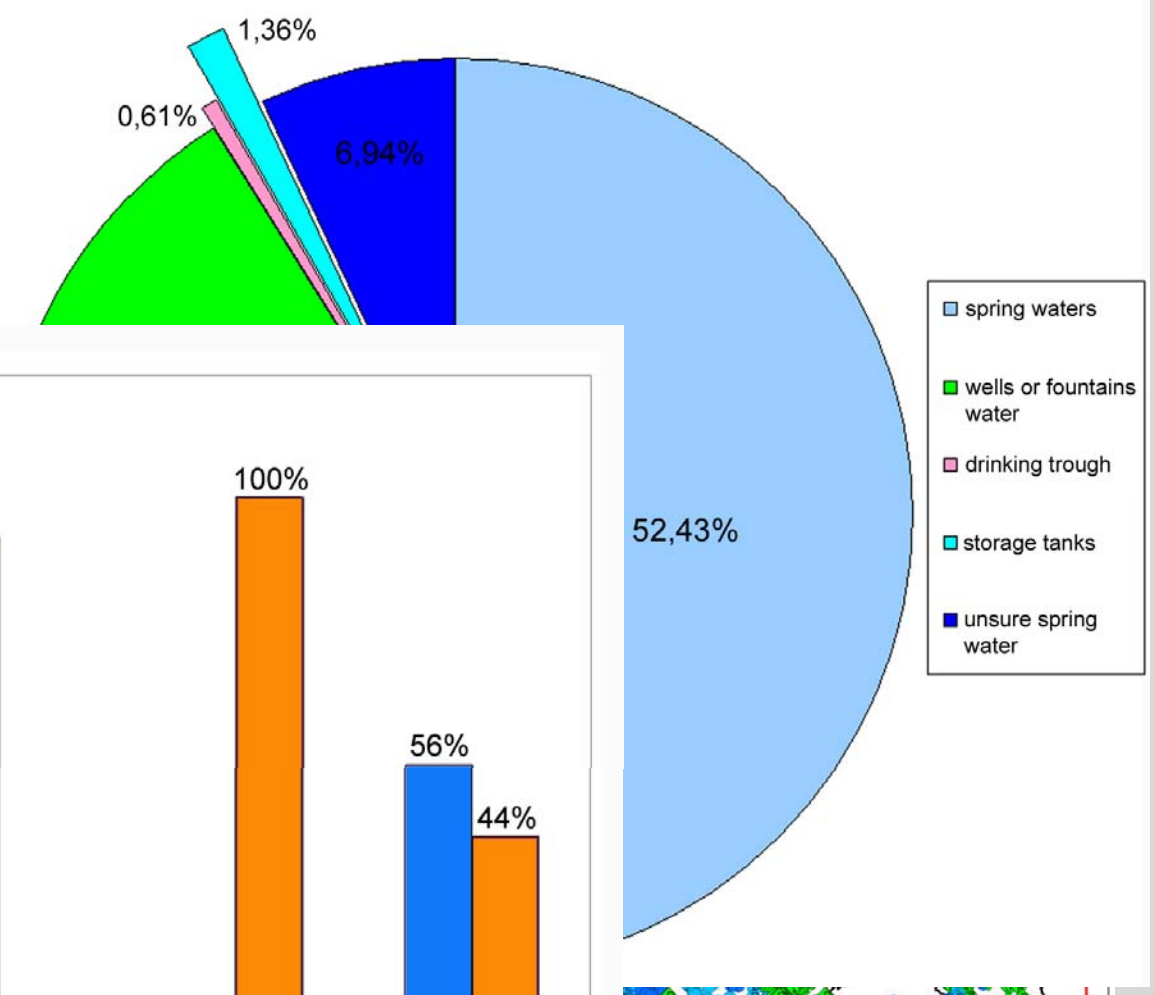
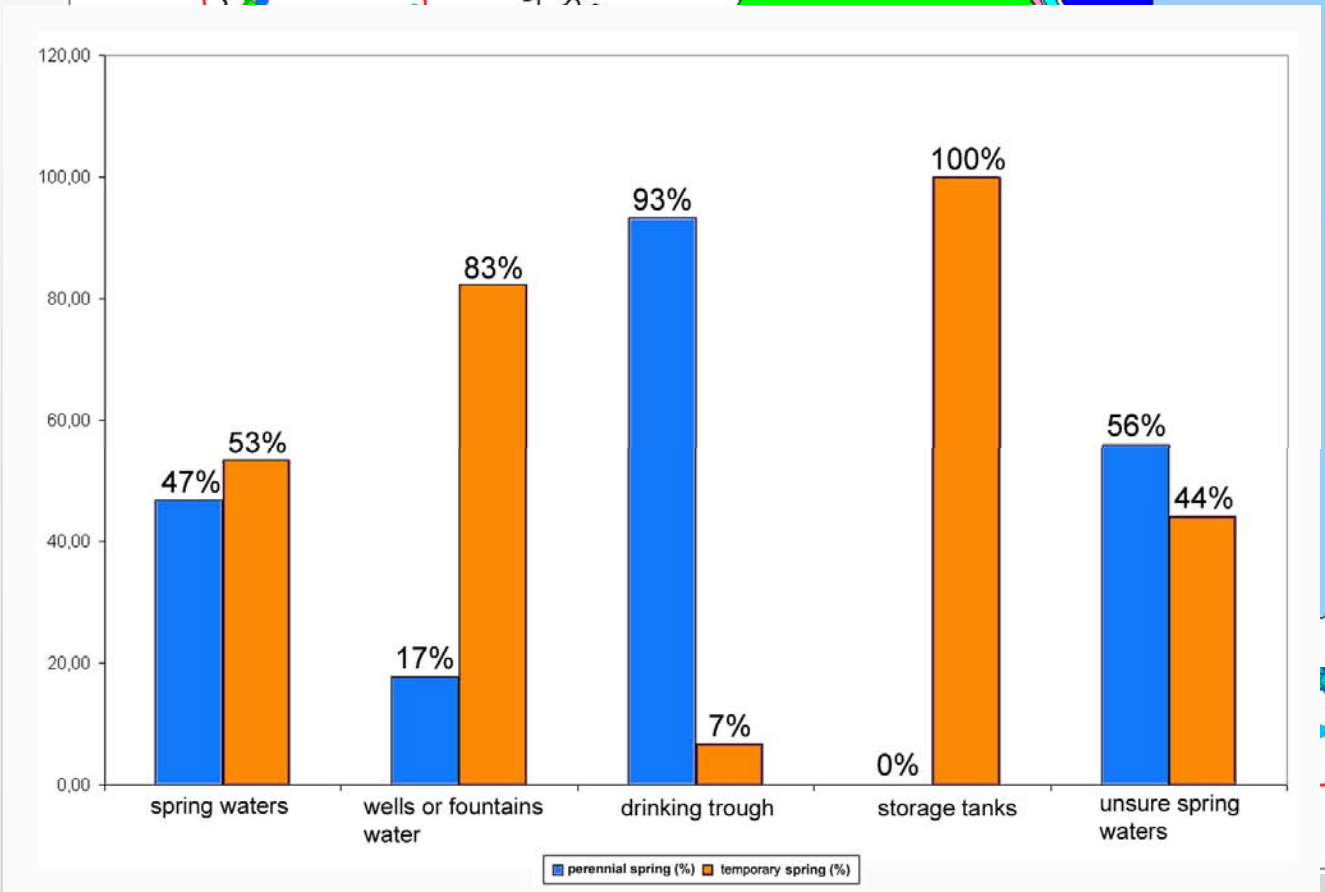
•results and web application

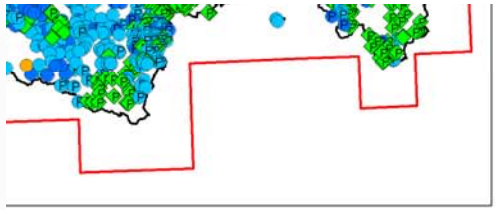
It is important to bear in mind that there is no uniformity between the tables.

For example, some tables make no distinction between perennial and temporary springs; in others the density of symbols relating to points is variable, as is the possibility of confusing them with themes relating to springs.

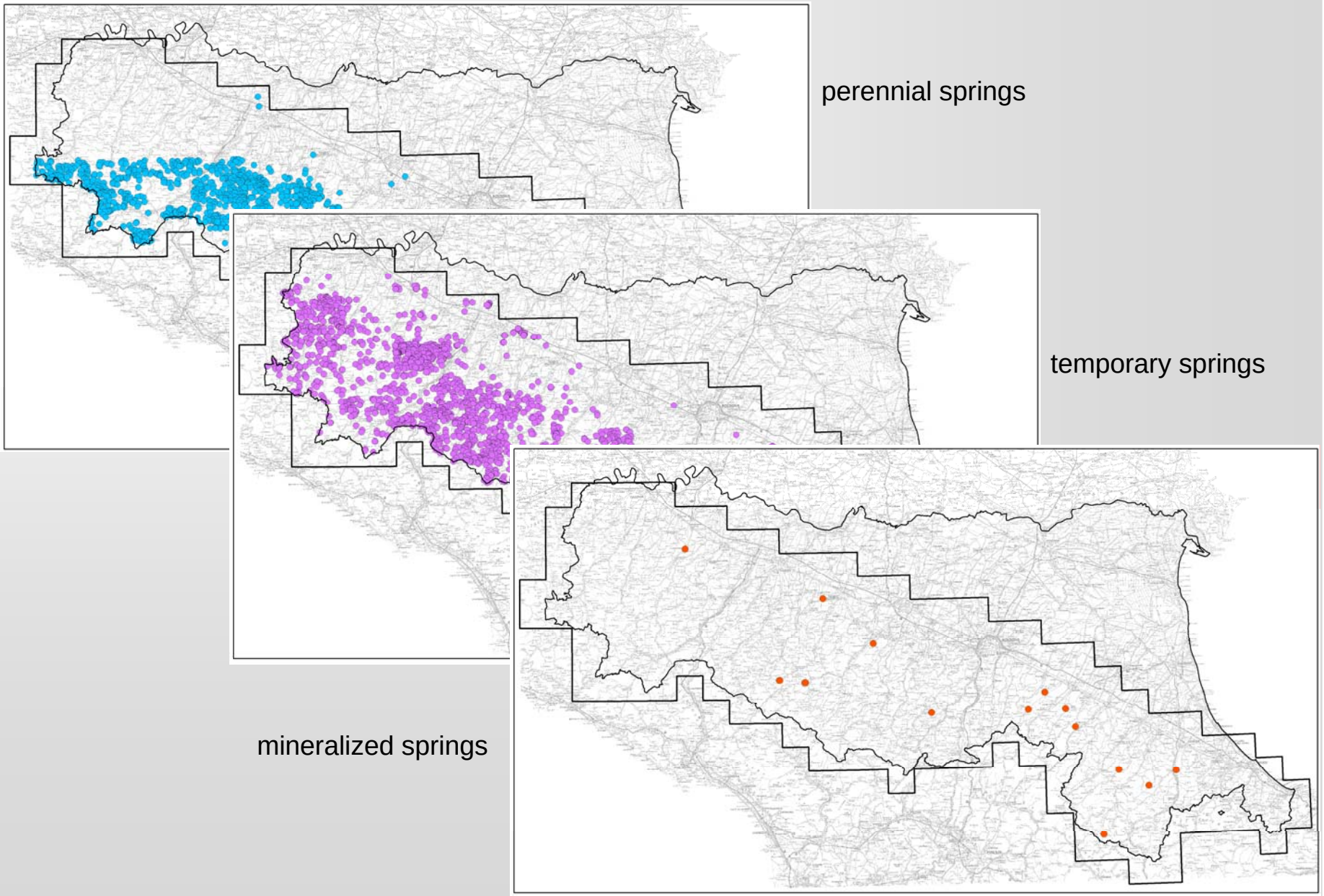








- results and web application



perennial springs

temporary springs

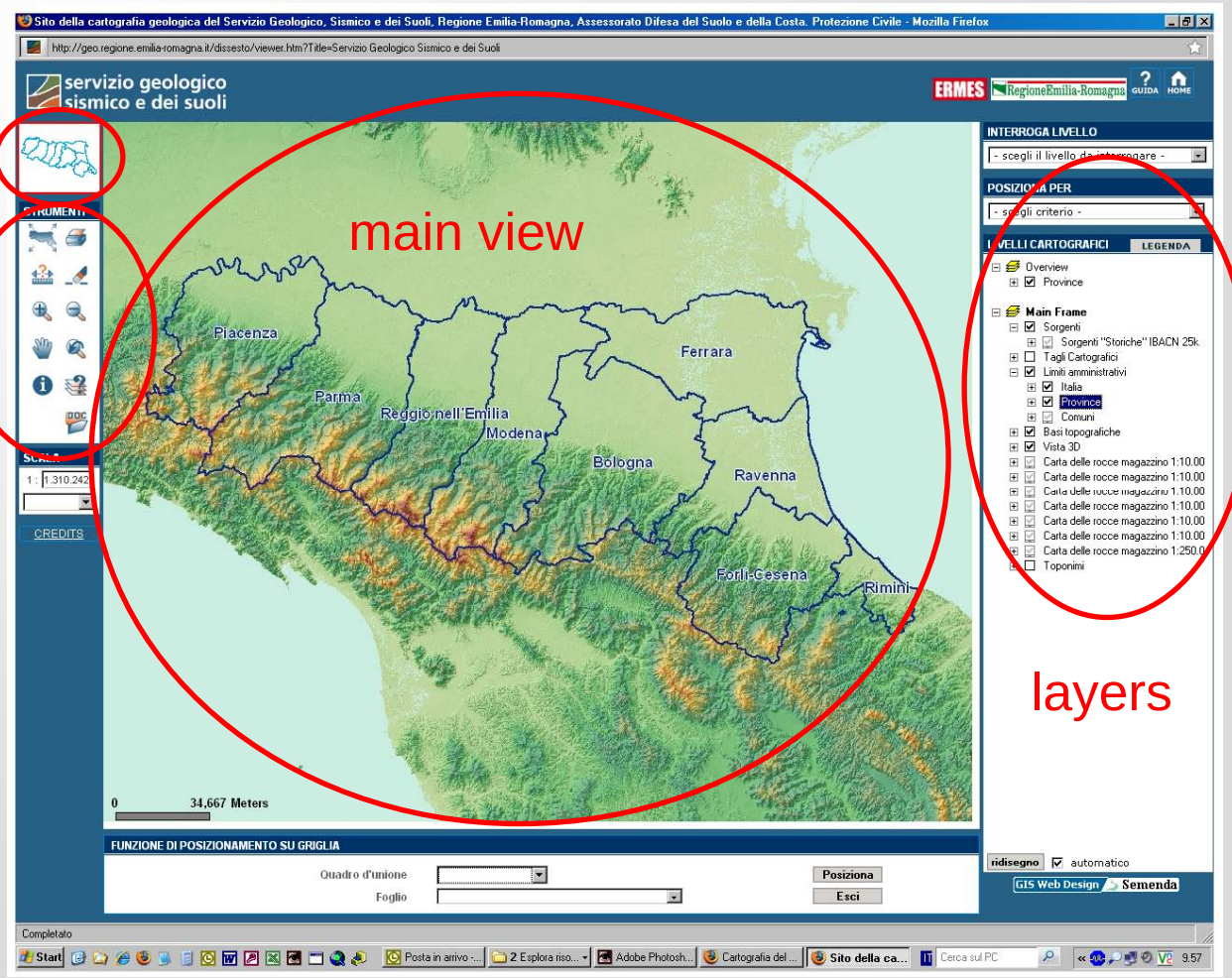
mineralized springs

- results and web application

Web site in progress!

navigation window

navigation toolbar

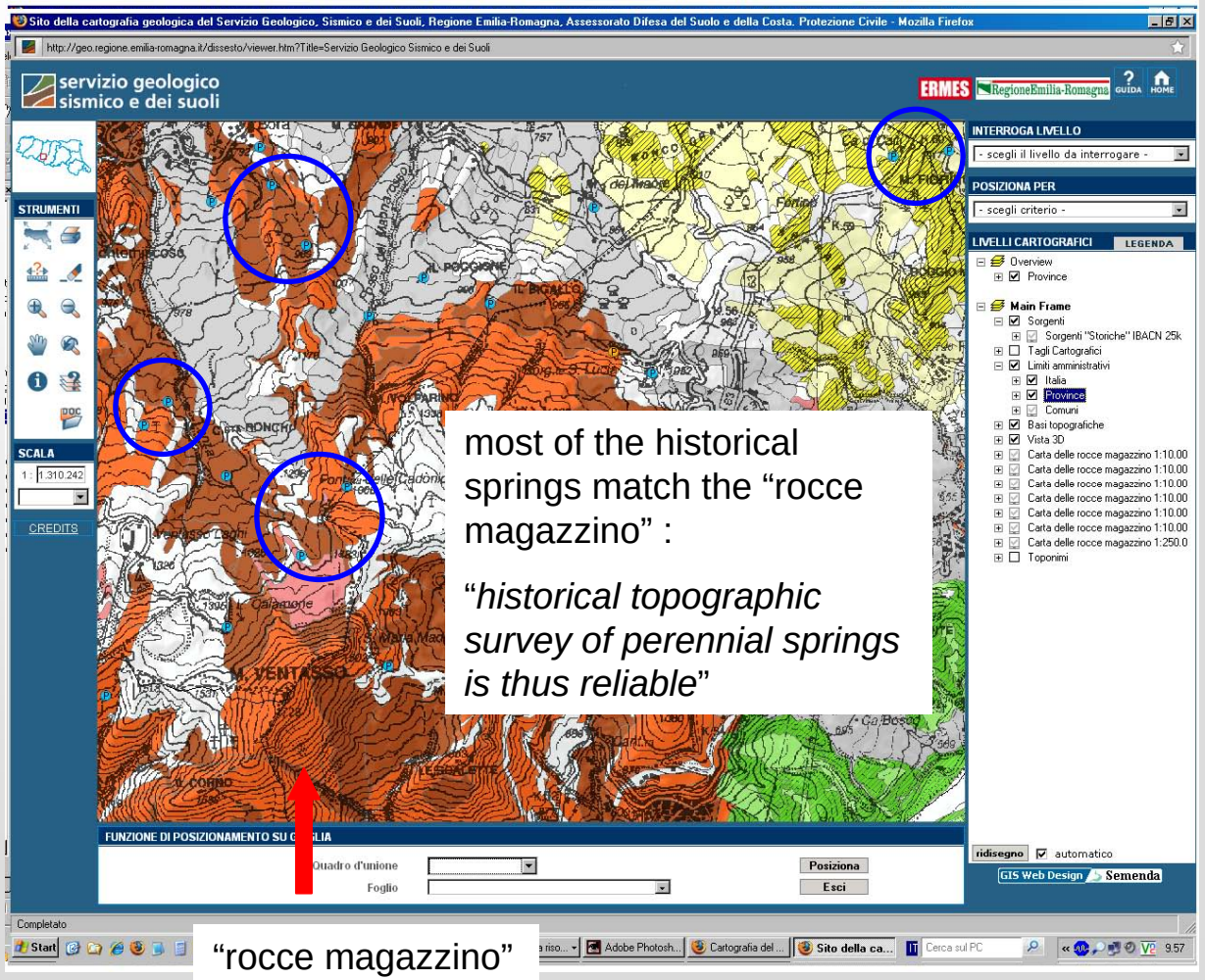


http://www.regione.emilia-romagna.it/geologia/

Contributions of Giulio Ercolessi, SGSS

• results and web application

It's still a work in progress!



most of the historical springs match the "rocce magazzino" :

"*historical topographic survey of perennial springs is thus reliable*"

"rocce magazzino"

1:25,000

http://www.regione.emilia-romagna.it/geologia/

* "rocce magazzino" (water storage rocks): geological units containing aquifers, strategical for drinking water supply

RegioneEmilia-Romagna

servizio geologico sismico e dei suoli

Istituto per i beni artistici culturali e naturali

Database on springs documented in historical maps : further applications

- hydrogeological studies in selected areas, focused on the local evolutive setting
- land use and groundwater planning
- studies about historical evolution of urban settlements