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Impression & Pattern Evidence Symposium
August 2–5, 2010, Florida

Statistical approach for an efficient use of footwear marks in crime analysis

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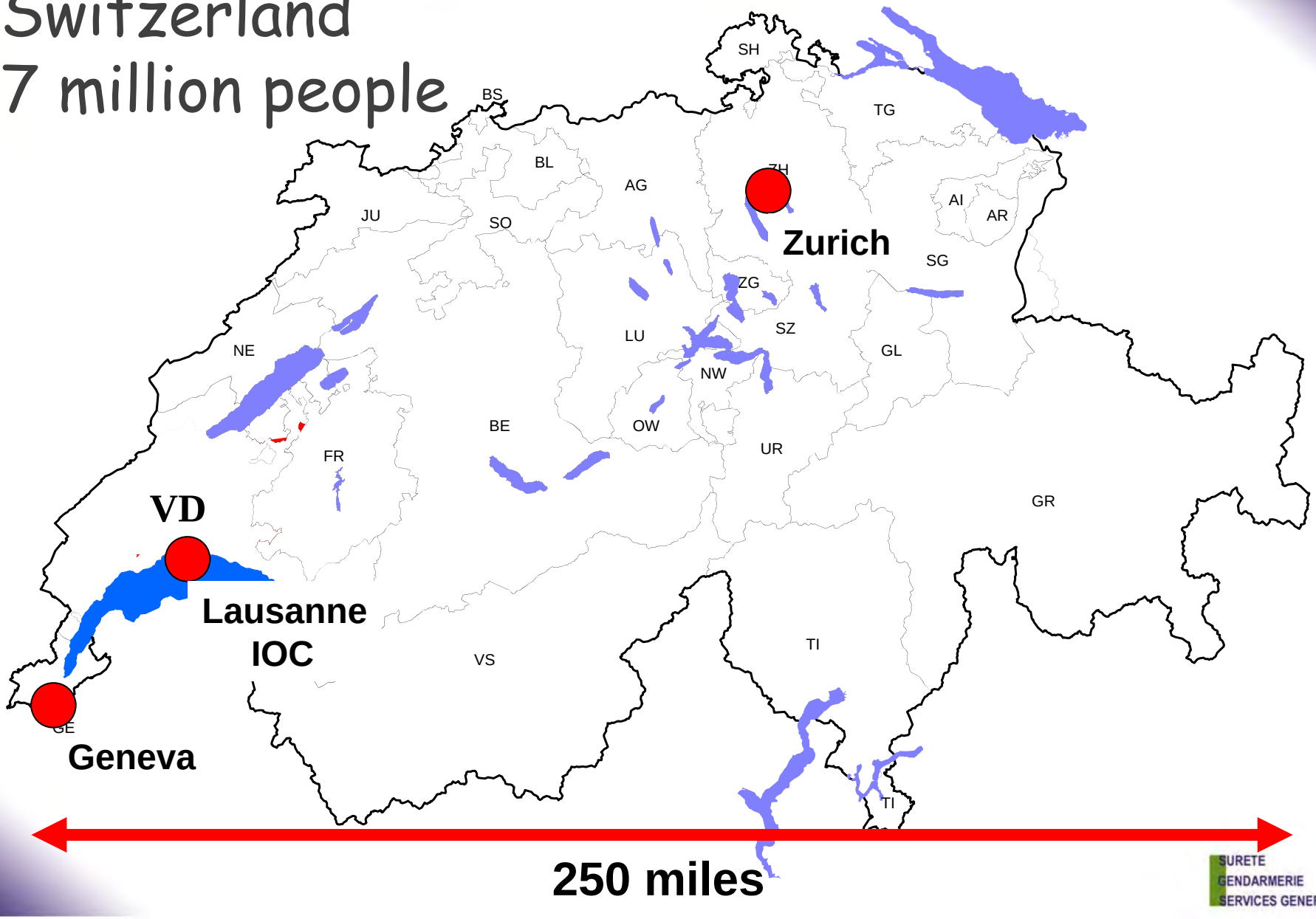
Switzerland
7 million people



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Introduction

- Serious Crime
- Property Crime

- Physical evidence
- Reference material

- The aim is always the identification of the offender(s) through the collected physical evidence

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Crime analysis

• Serious Crime

- Important resources, many physical evidence
- Without suspect, Police forces are always in trouble !

• Property Crime

- Less resources for work, physical evidence
- Without suspect, we wait on another case(s), on "other chance"
- Police forces have in such cases not too much pressure *

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Source attribution

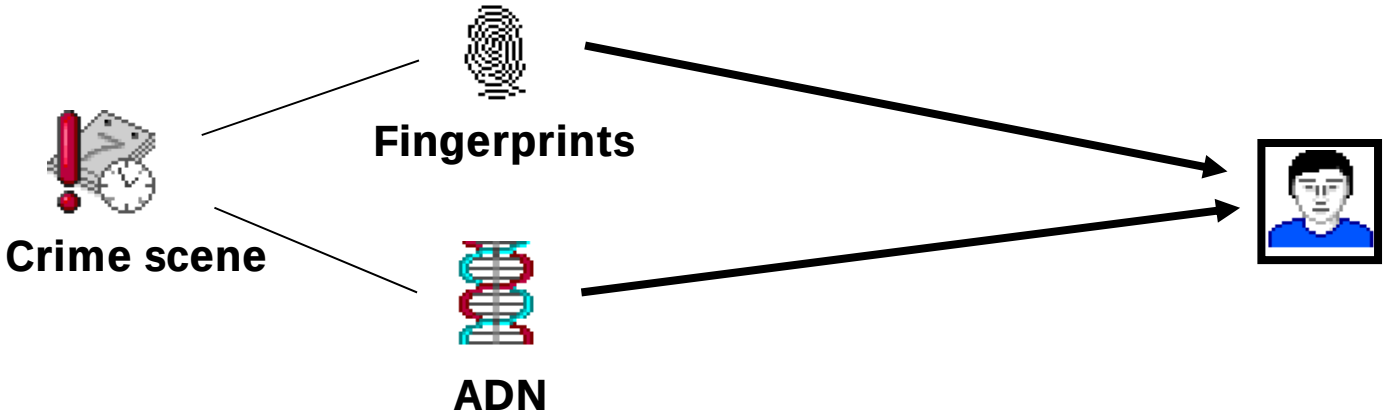
Physical evidence collected on crime scenes

Will trigger police Investigation on the source

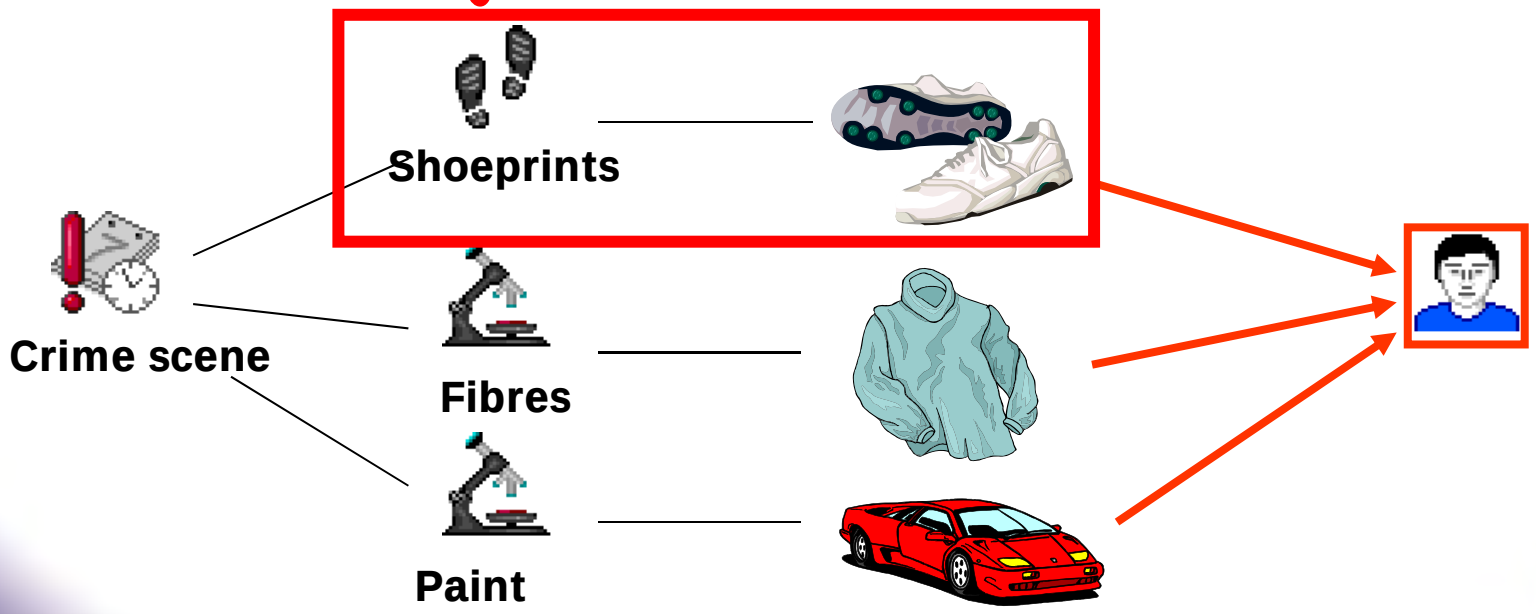
Potential source(s)

Attribution of the source ≠ Identification of the offender

- Links with Human ID marks



- Links with Objects ID marks



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Shoeprints potential

- Shoeprints are a type of physical evidence often collected
- Identification process is seen as the most important aim
- Probability to attribute shoeprints to knowns is relatively rare
- We need "relevant" suspects' pairs of shoes and their collection is never easy

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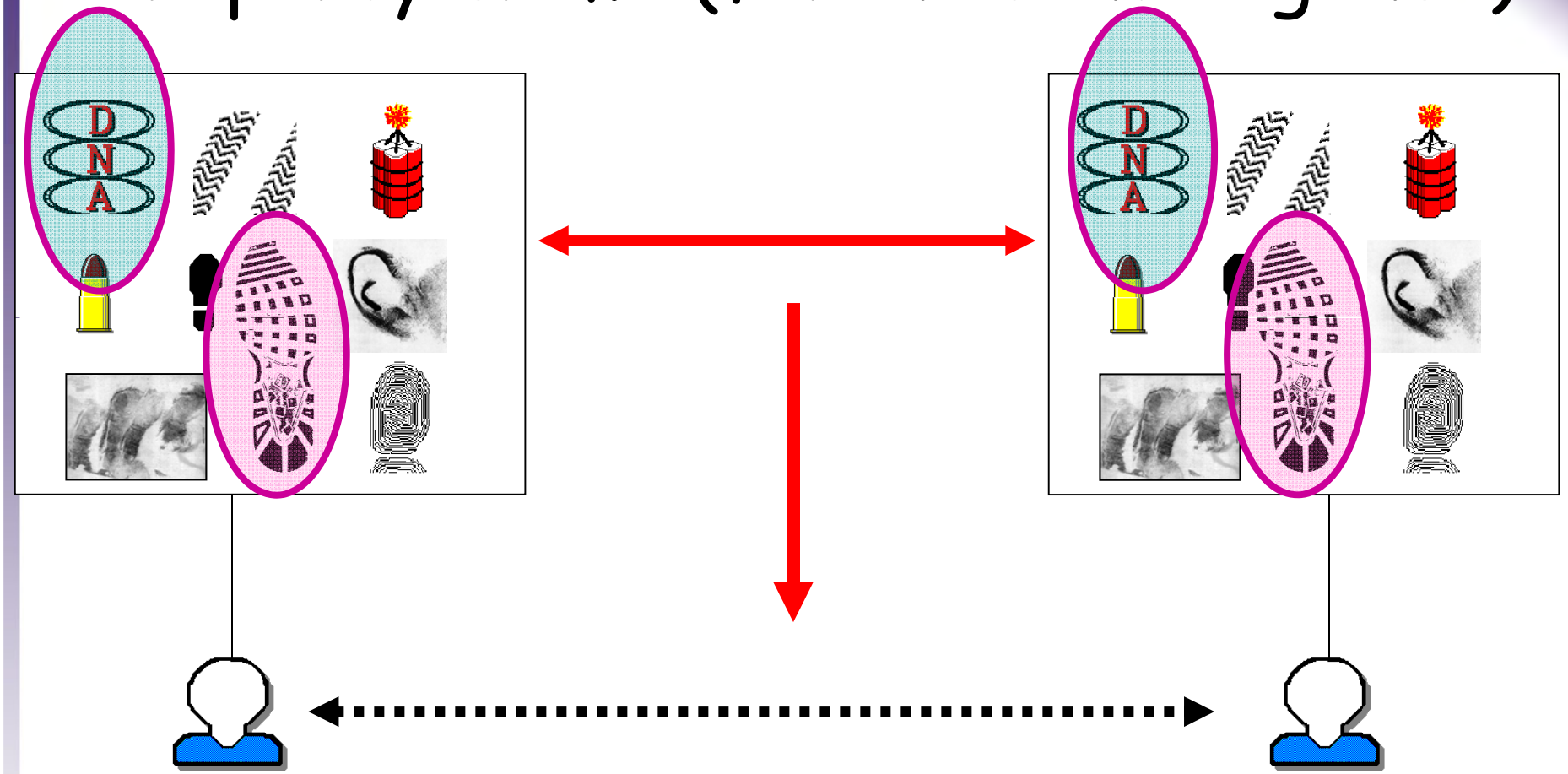
Property crime (forensic intelligence)



The potential source is here unknown !

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Shoeprints potential

- What is the value of such investigative links (general design only) ?
- What is the efficient strategy for such a use ?
- You need :
  - A **database** with a simple and relevant codification system
  - **Staff**, who codifies all the different designs, and
  - **Analyst**(s), who links the shoeprints with the same design and creates groups.

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First Step

Groups analysis

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Shoeprints Intelligence

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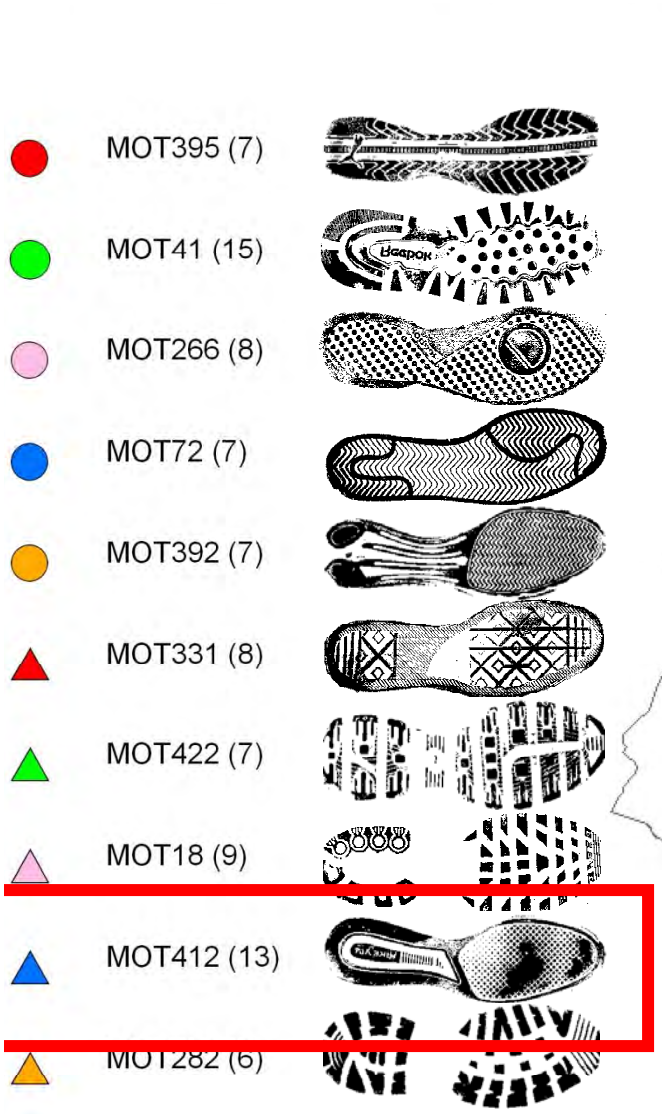
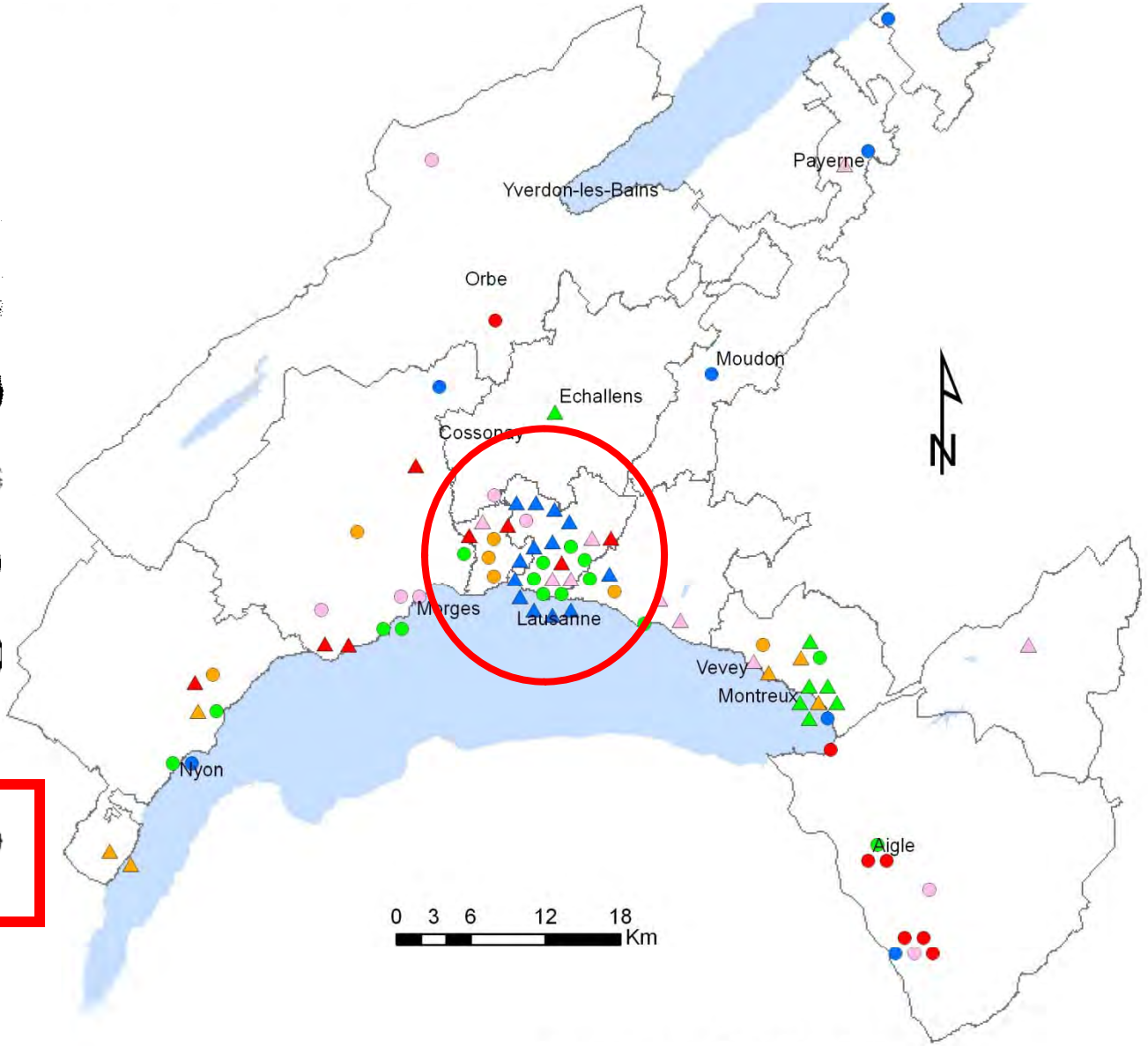
Shoeprints Intelligence

Other designs

Shoeprints Intelligence (January - February 09)





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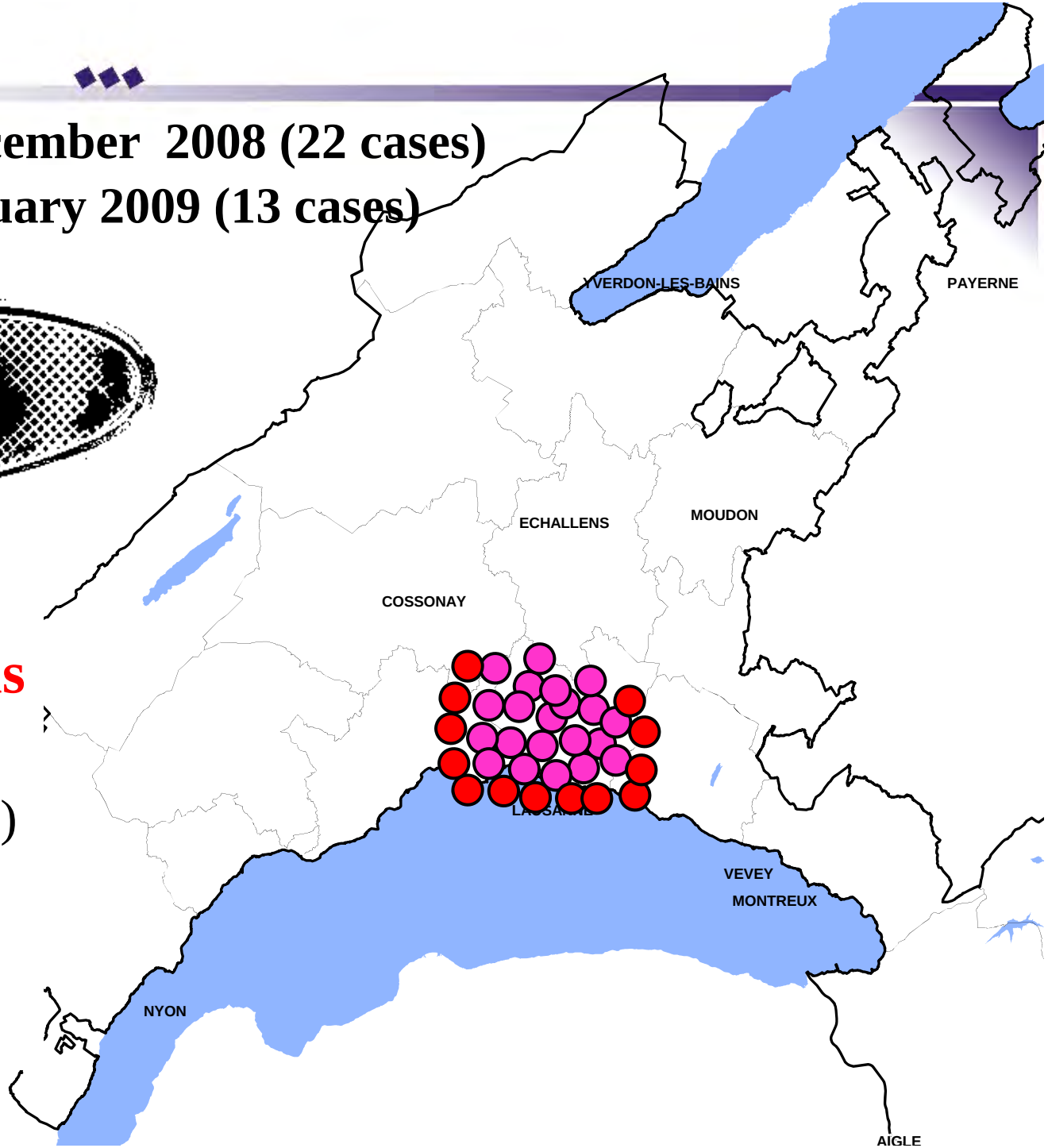
- **November - December 2008 (22 cases)**
- **January – February 2009 (13 cases)**



35 cases

11 Identifications

17 very probably
(very strong support)

8 probably
(moderate support)

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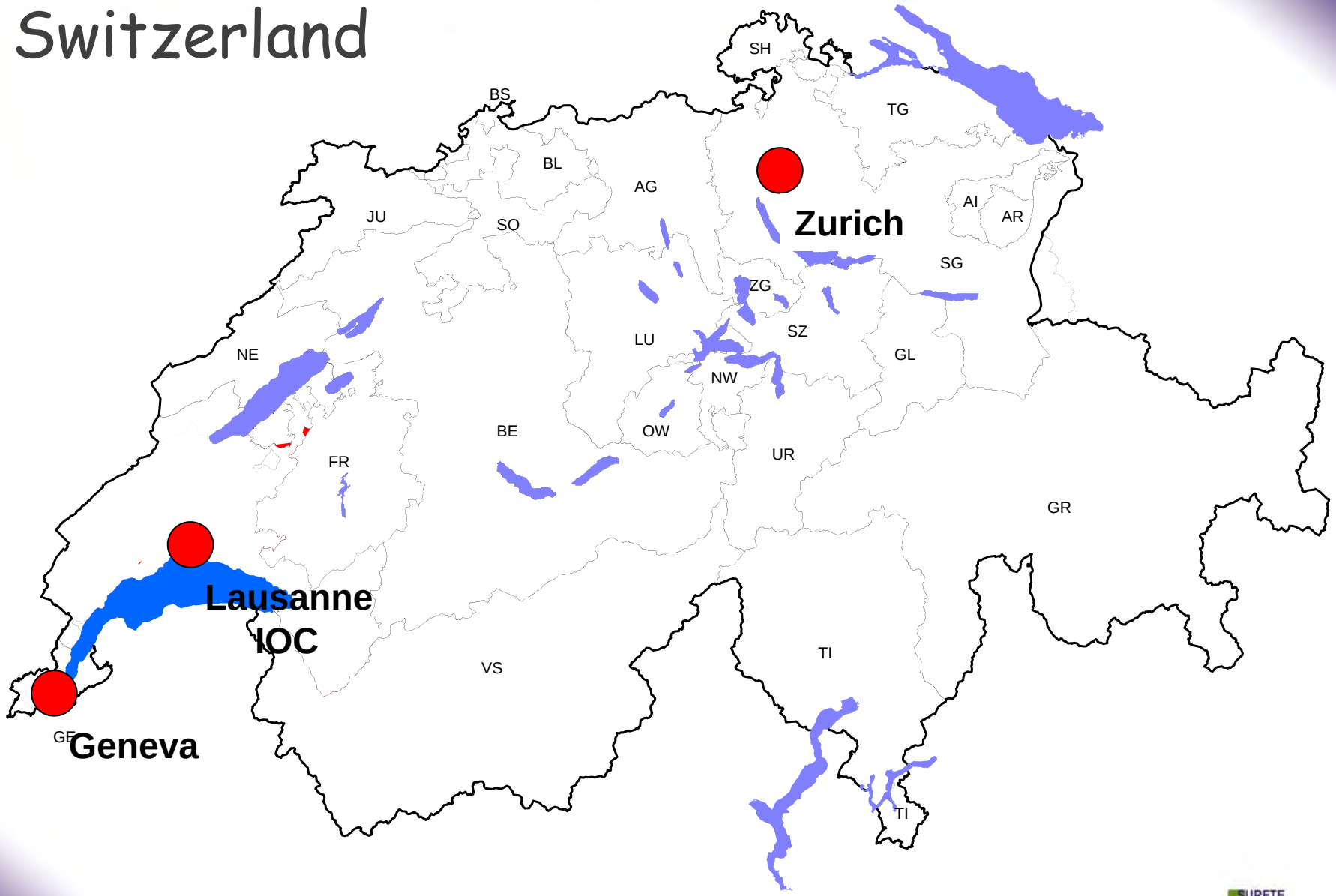
Switzerland



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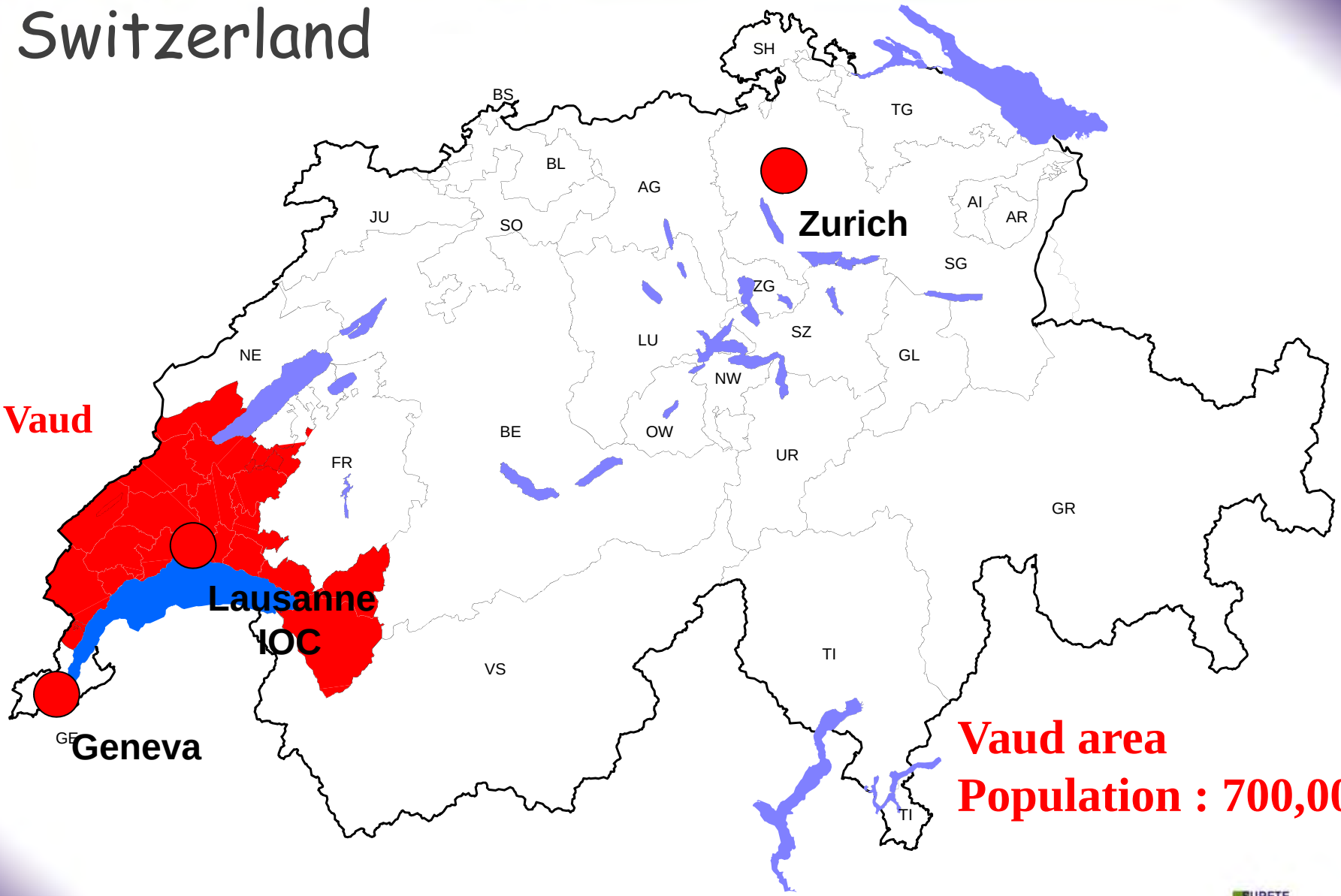
Switzerland



Vaud area
Population : 700,000

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Second Step

Occurrences analysis

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Research and results

- Do we find often several times the same designs ?
- If yes, what is the proportion of occurrences ?
- Roughly **70 % of the designs** collected are found only one or twice on crime scenes **during 11 years** (1998 – 2009, N > 12,000).
- **Hence** : We have about **30 %** of shoeprints collected available for our crime analysis !

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Research and results

- This proportion of **70 %** is important and surprising.
- The other designs (**30 %**, n > 4,000) were distributed in 404 clusters that range from 3 to 172 occurrences.
- The next graph shows the distribution of these clusters with their occurrences.

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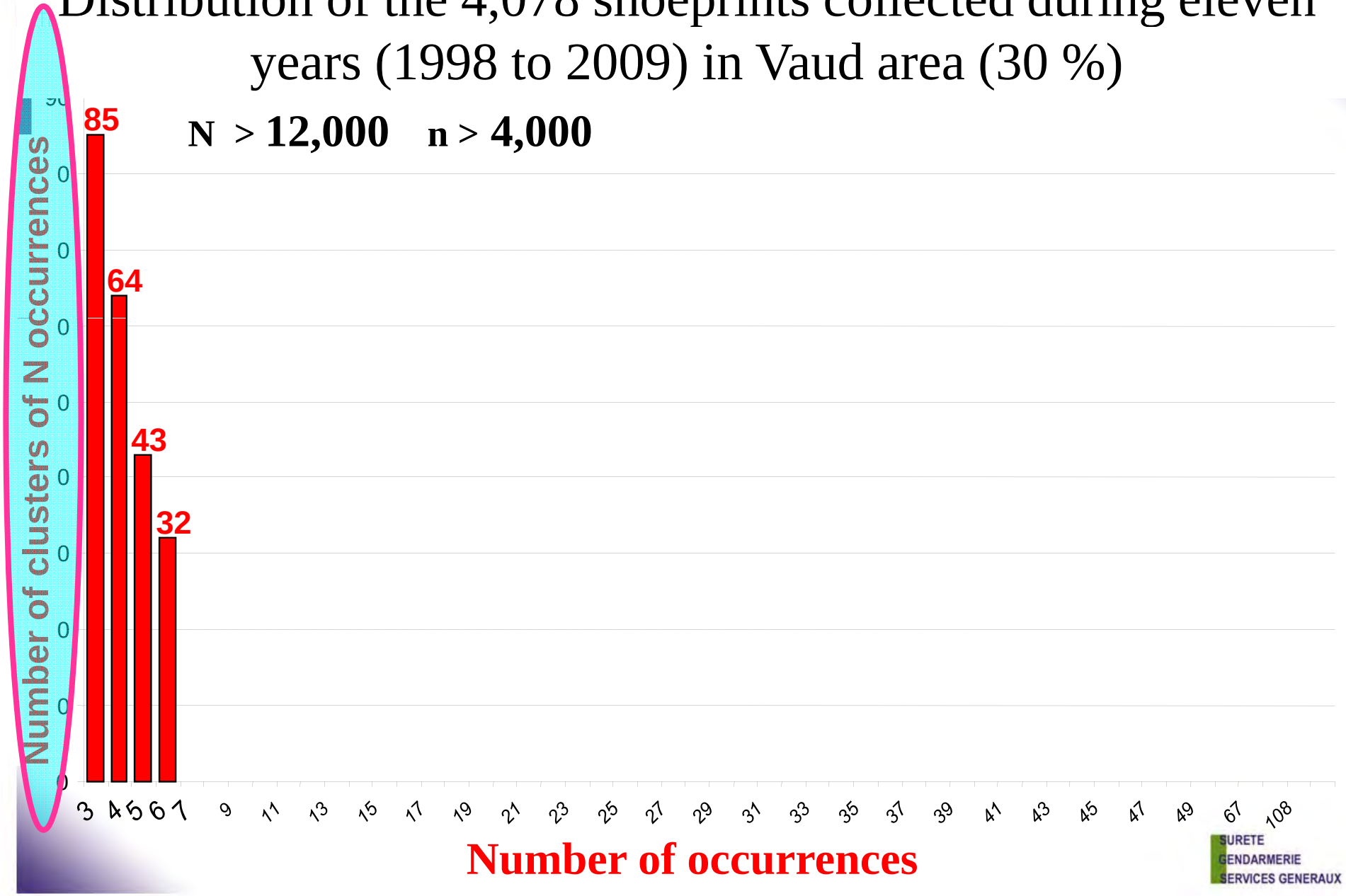
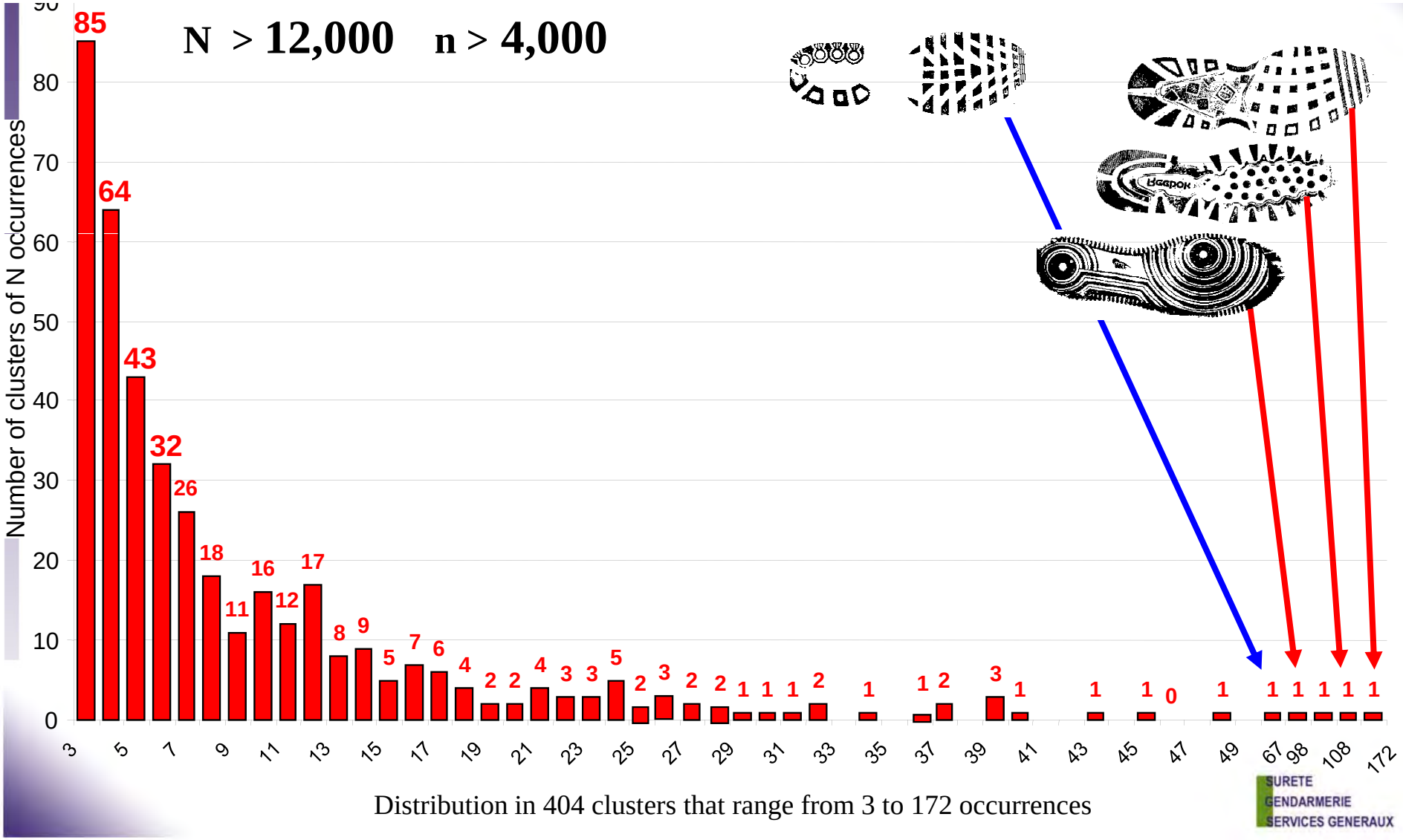
Distribution of the 4,078 shoeprints collected during eleven years (1998 to 2009) in Vaud area (30 %)



Distribution of the 4,078 shoeprints collected during eleven years (1998 to 2009) in Vaud area (30 %)



Distribution in 404 clusters that range from 3 to 172 occurrences

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Time analysis

- A same design collected several times in the same area could be efficient for a crime analysis.
- Particularly if the period of time is short and the number of occurrences important.
- What is **the life time of the different designs** collected on crime scenes in Vaud area ?

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Third Step

Time analysis

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Life time analysis

- **42 %** of the designs have a life time **less than three months.**
- **58 %** have a life time **less than one year.**
- **16 % between one and two years.**
- **12 % between two and three years.**
- **Hence** : Around **60 %** of shoeprints collected can be used for crime analysis because their life time is less than 1 year

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Comparisons between time and occurrences

- Many designs have a **long life time** with a small number of occurrences.
- Other have a **long life time too** but with a large number of occurrences.
- Many designs have a short life time with a small number of occurrences.
- Designs have a **short life time** with a **large number of occurrences**.

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4th Step

Life time and occurrences analysis

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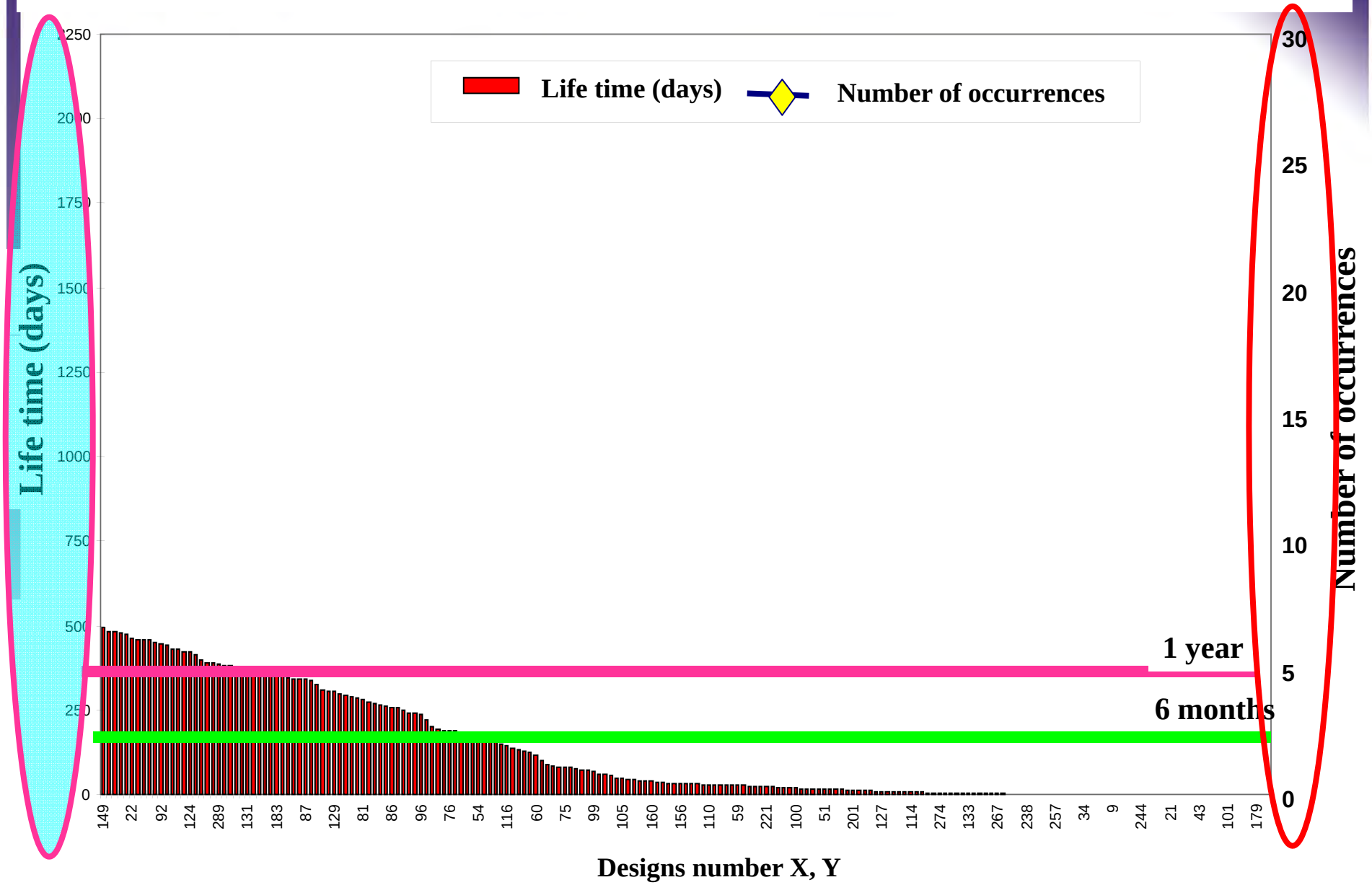
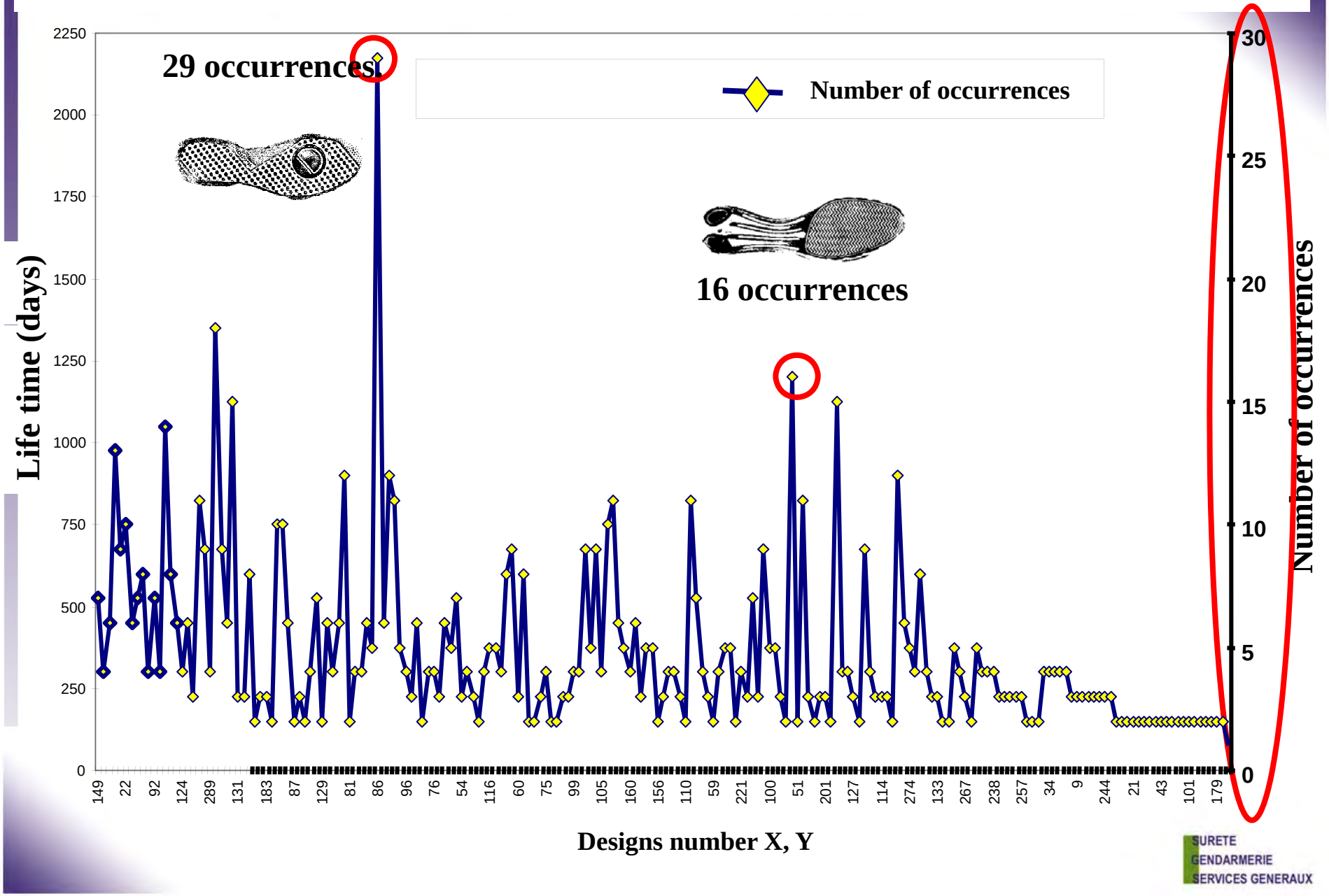
Comparisons between lifetime and occurrences



Comparisons between lifetime and occurrences



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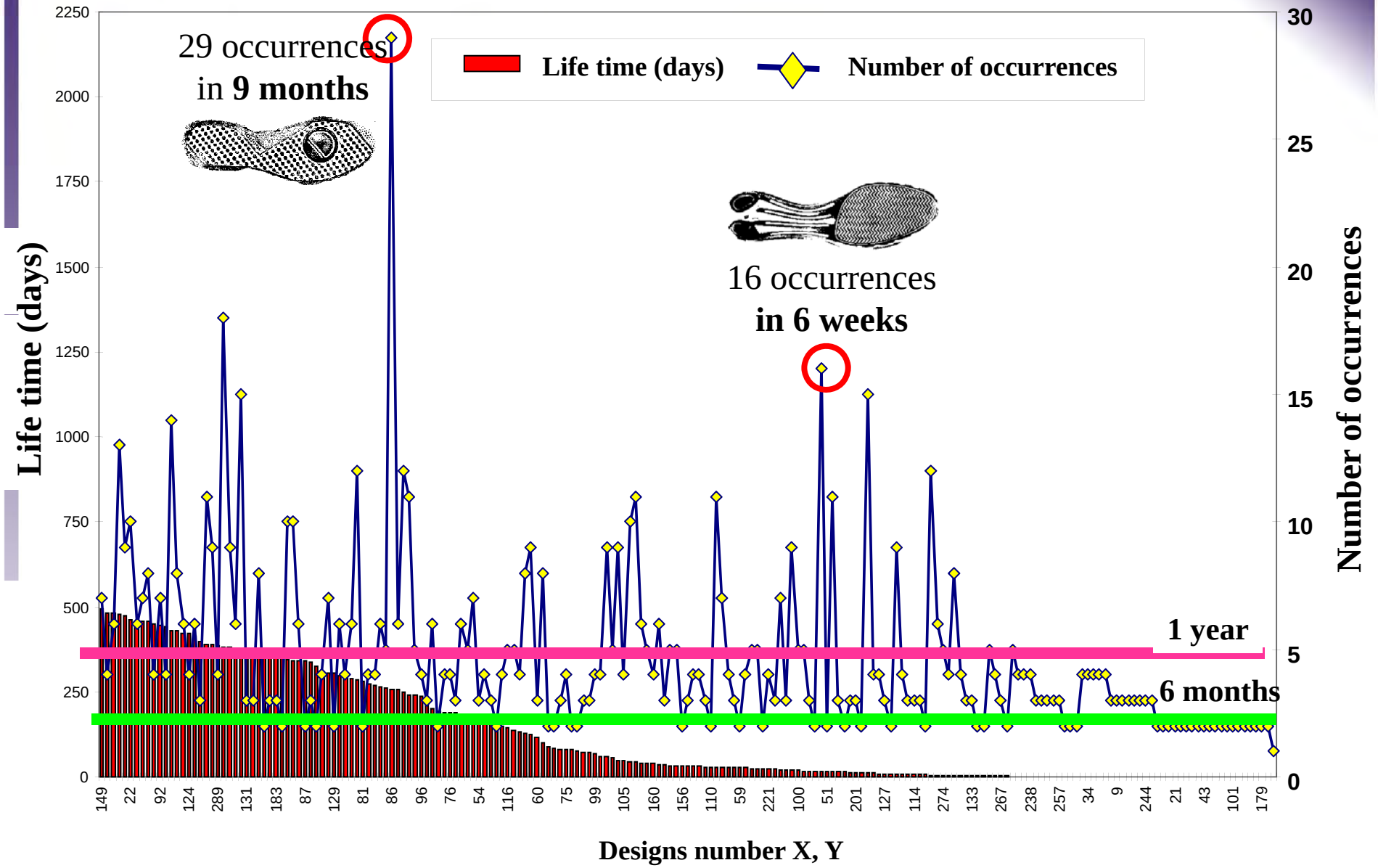
Comparisons between lifetime and occurrences



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Comparisons between lifetime and occurrences

- Designs with a number of occurrences higher than 5 or 10 is retained for crime analysis in Vaud area

- Particularly, if the designs have a short life time (less than six months)

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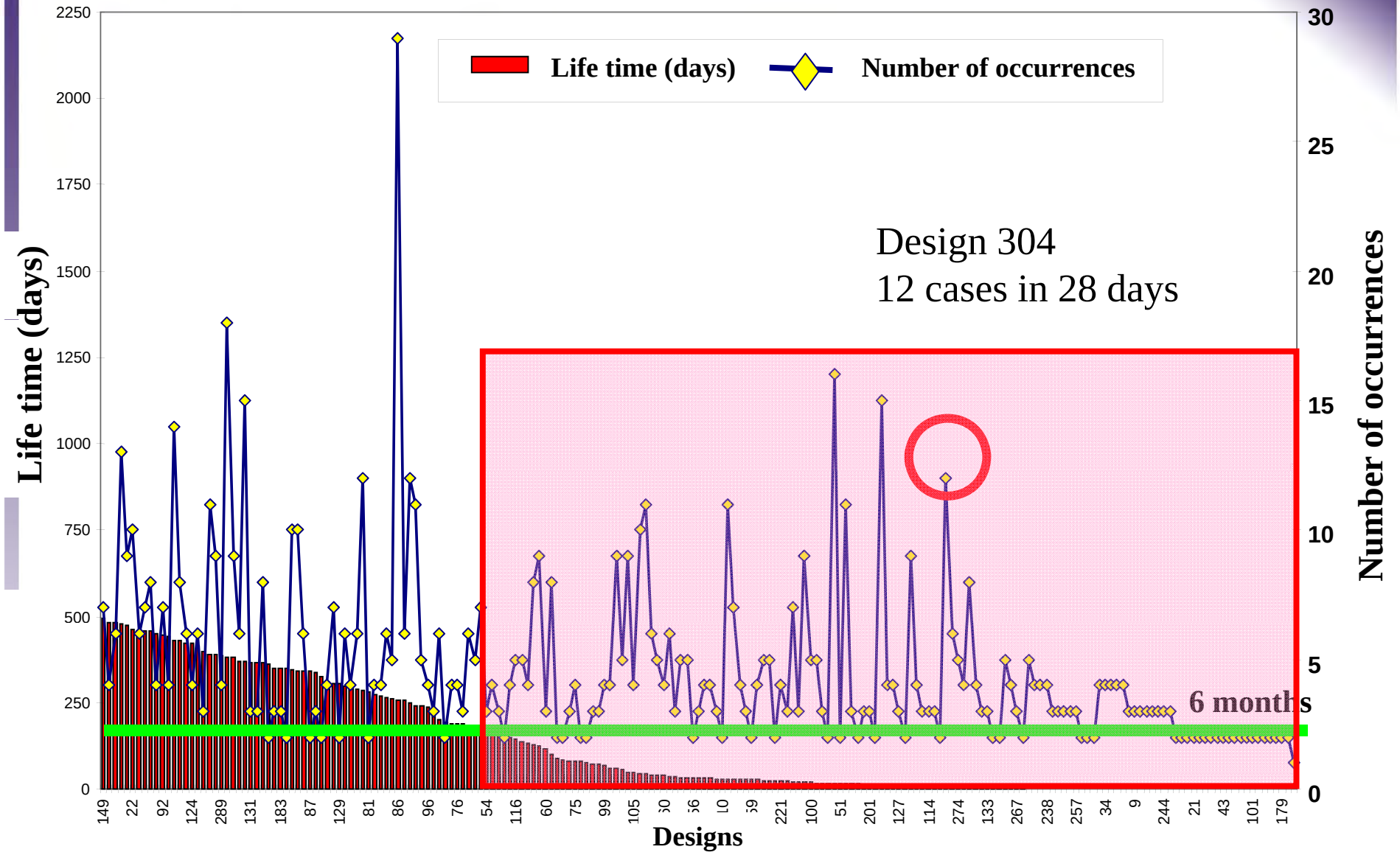
Comparisons between time and occurrences



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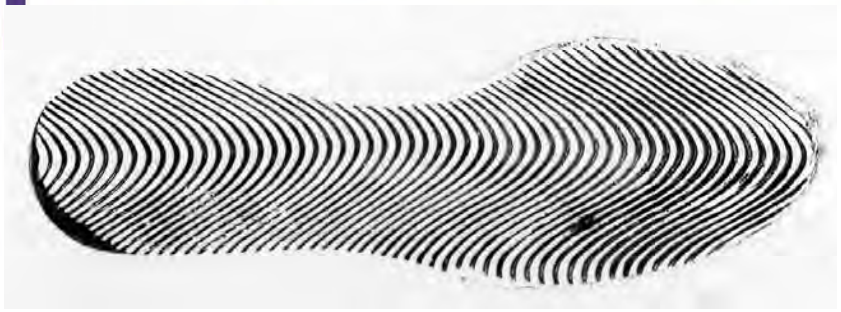
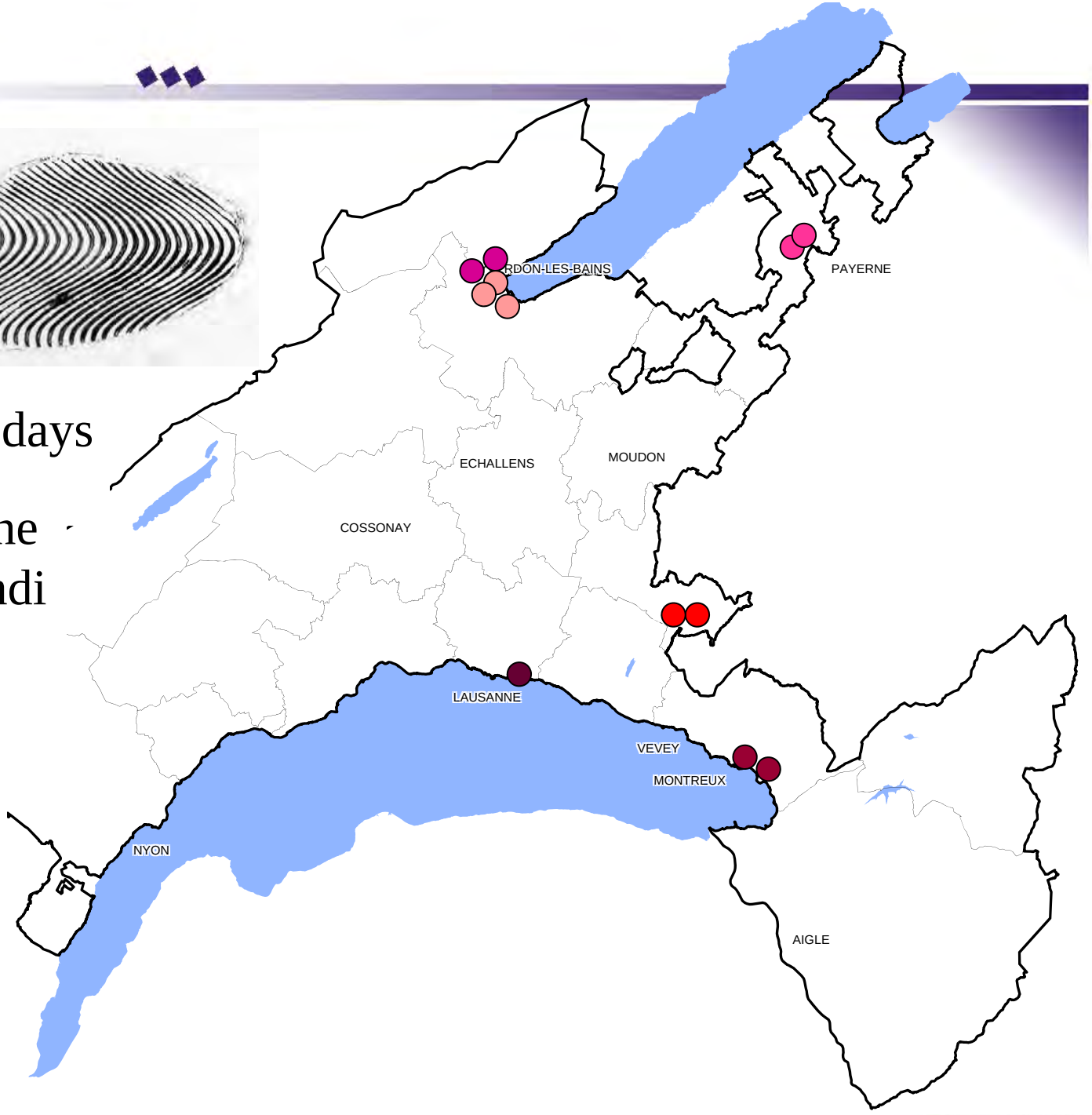


12 burglaries in 28 days

In 12 houses with the same modus operandi

Design never seen before and never seen after this period of time



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Research and results

- With such good results, we decided to work with a bigger geographical area
- Romandie area with more than 2.5 million people
- We have to change our operational strategy and our IT infrastructure
- Because we have no time for analysing all the clusters of the different police forces

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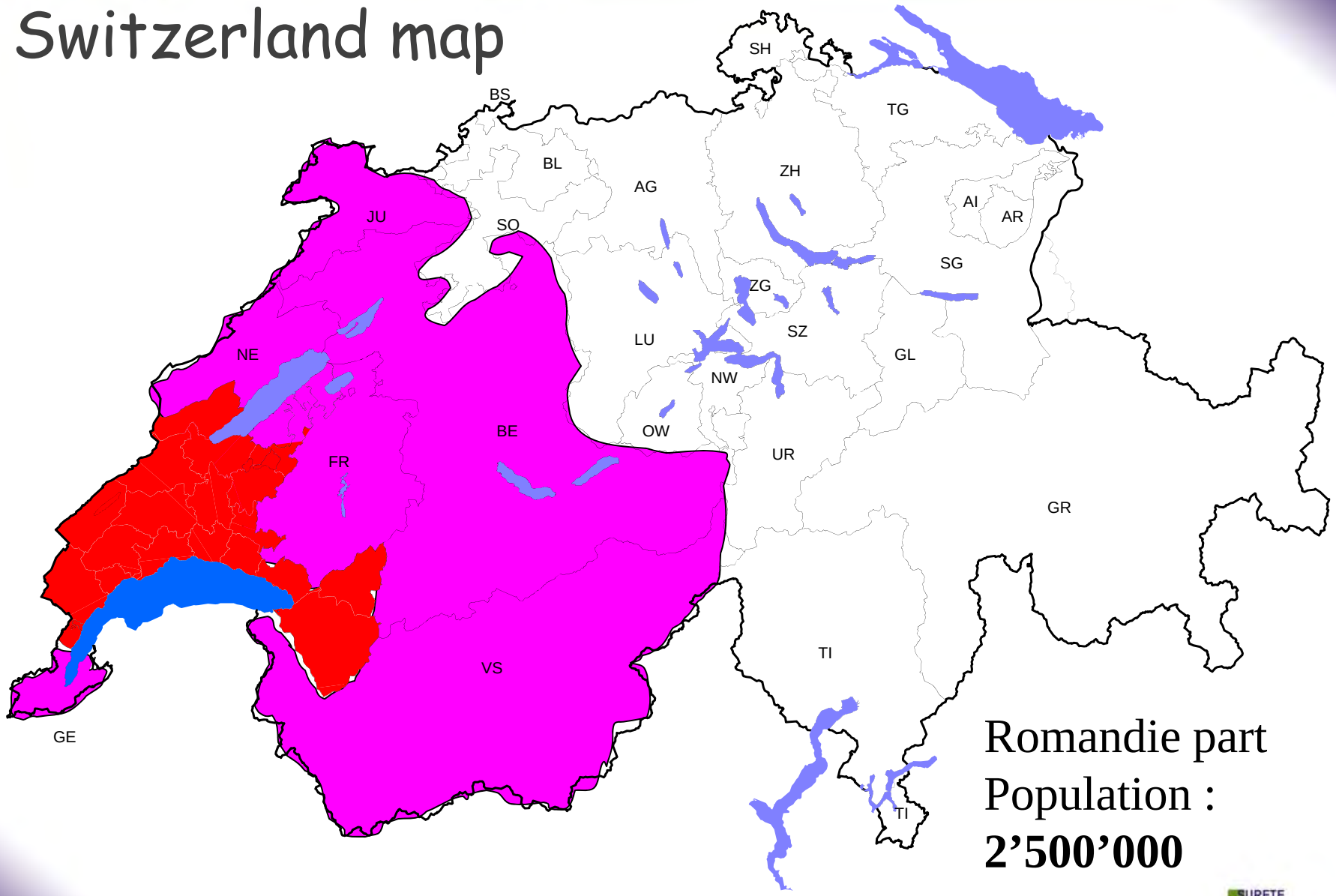
Switzerland map



Romandie part

Population :

2’500’000

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Research and results

- We obtain good results too
- The number of occurrences should be higher than 15 for an efficient crime analysis in this bigger area

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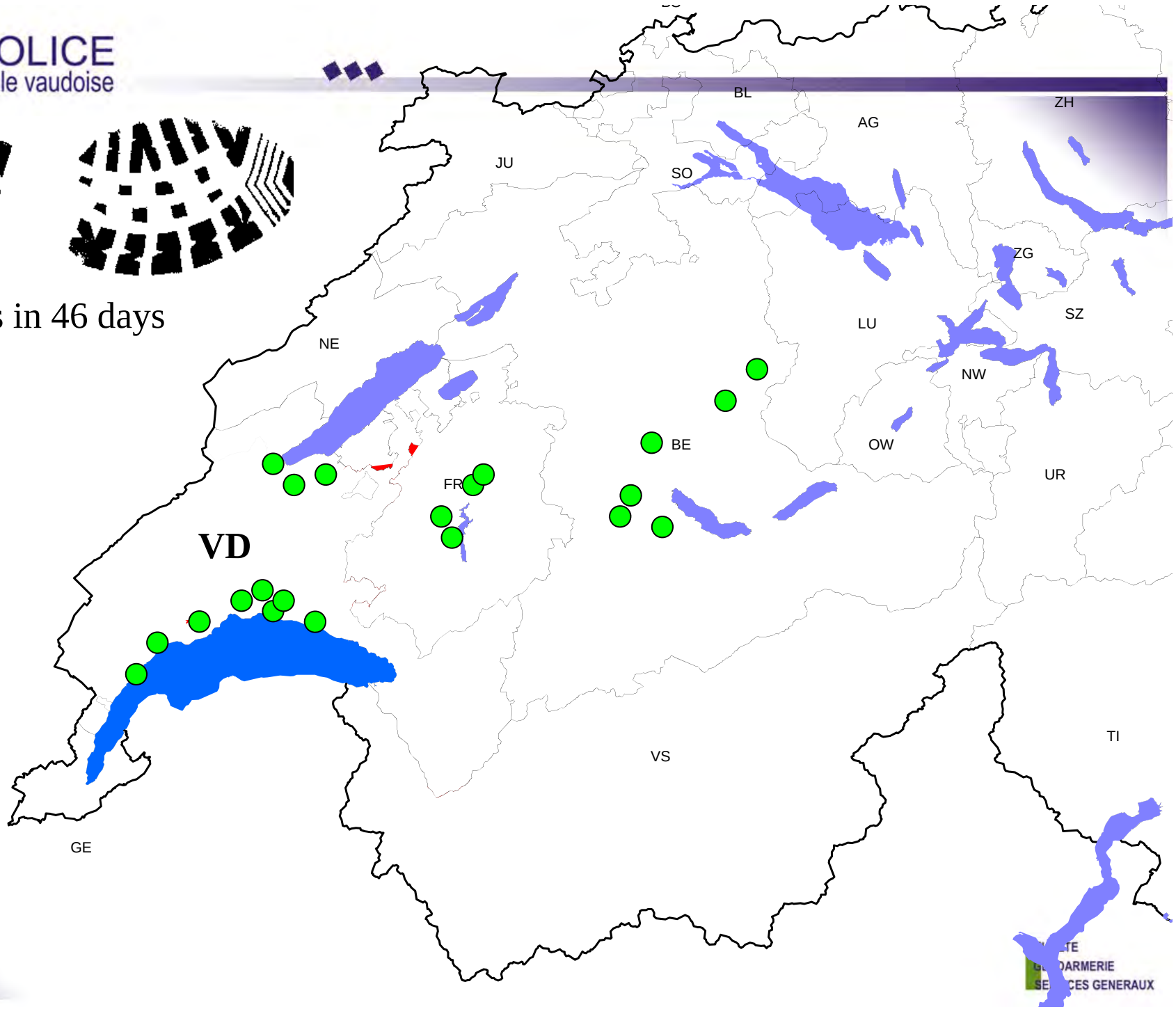
21 cases in 46 days



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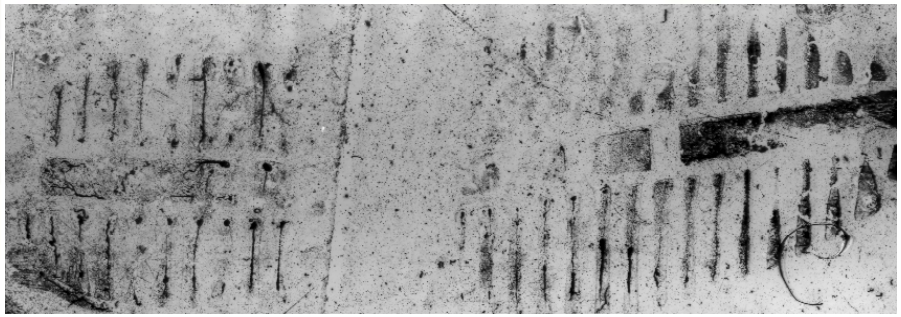
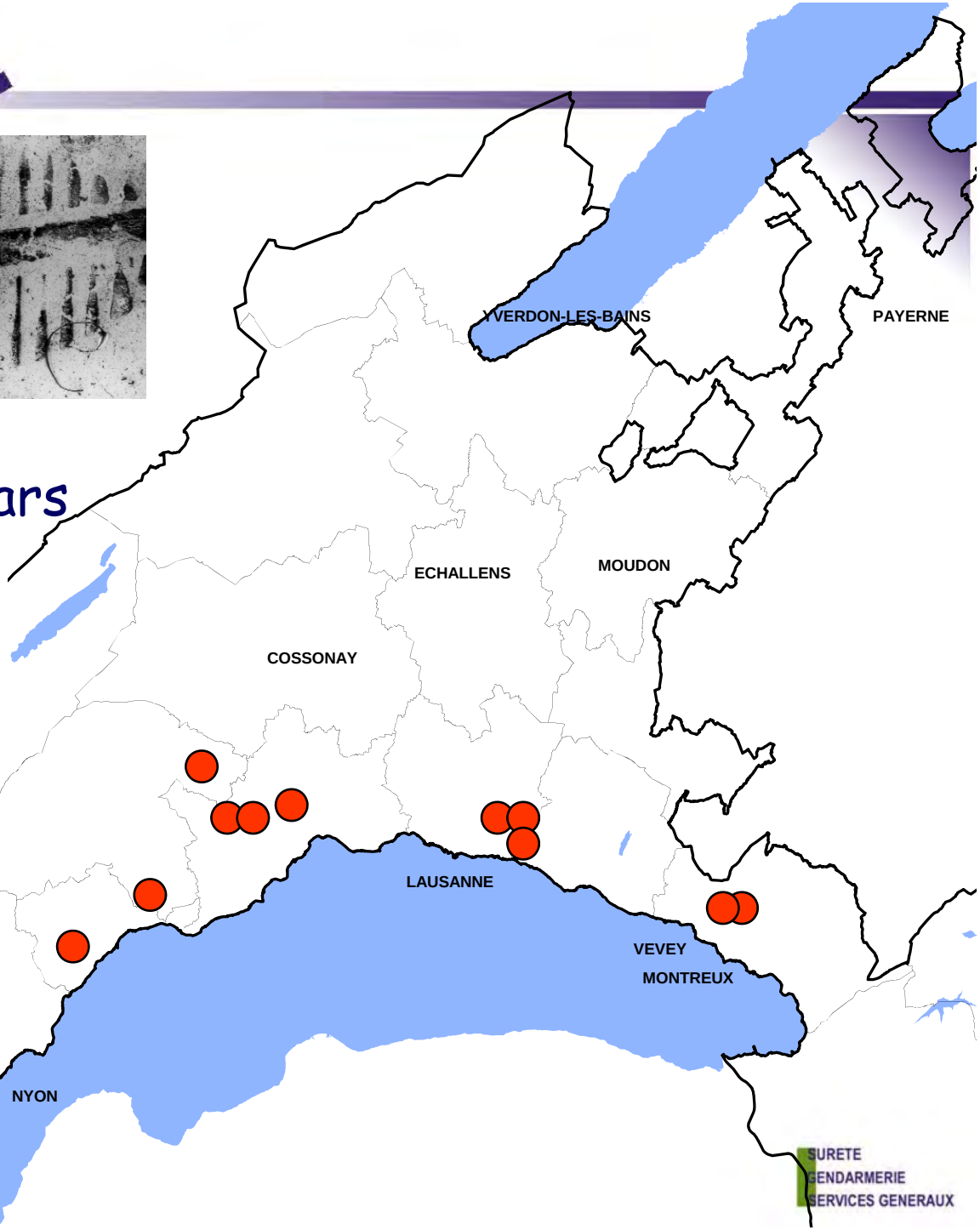


Design 456, **12 cases**
in 40 days during 11 years

Same target
Same modus operandi
Same periode of time

Same size
Same wear location



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Conclusion

- A statistical approach with shoeprints evidence could detect automatically the presence of potential links between different cases
- The presence of the same design could show burglars' activity, particularly when during a short period of time this number of occurrences is high

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Questions ?

Thank you

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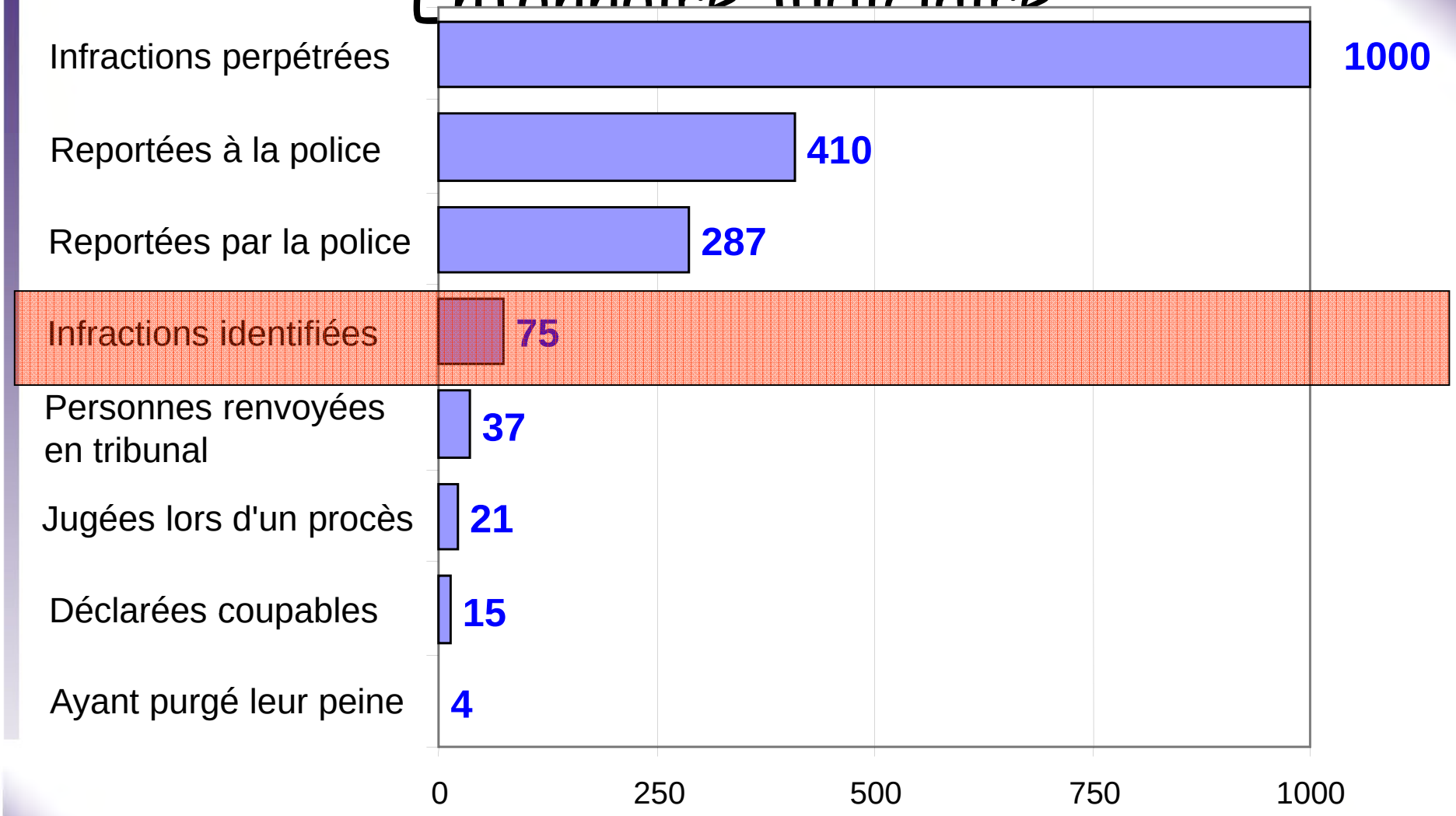
Entonnoir judiciaire



Intelligence-Led Policing, Jerry RATCLIFFE, 2007

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