

Seismic hazard assessments on a nuclear waste time scale

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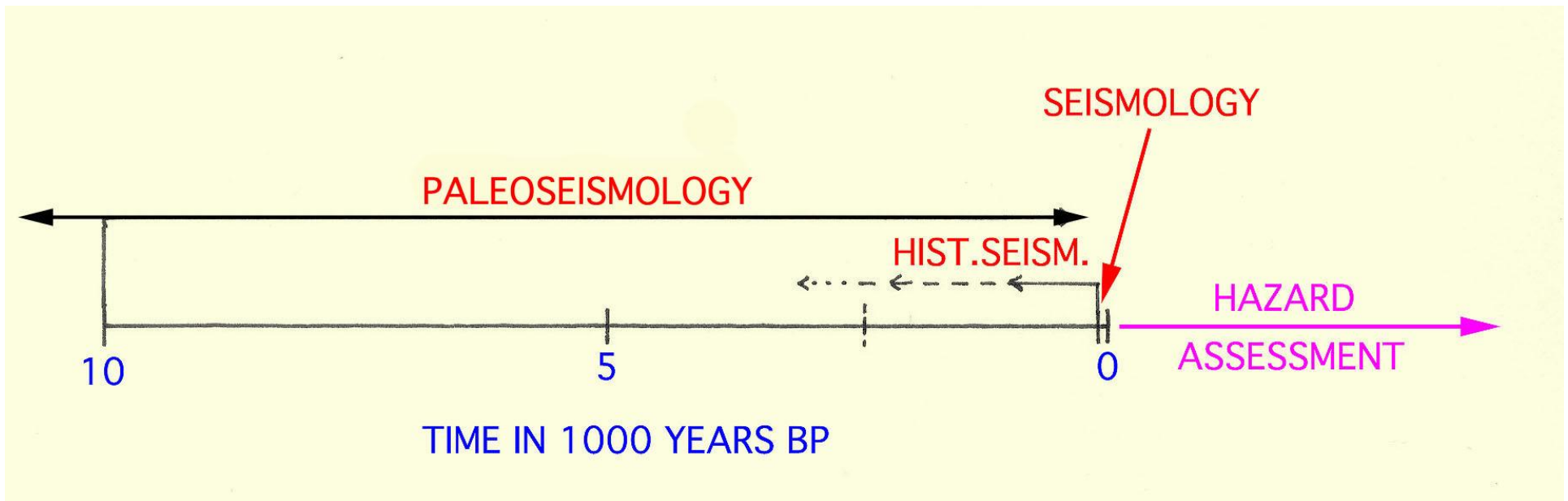
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President of the INQUA Neotectonics Commission 1981-1989 **Editor**
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Sweden and Finland

**are the only countries in the world
claiming that they can store
the high-level nuclear waste
in the bedrock
with full safety kept
for 100,000 to 1 million years**

**What do we paleoseismologists say
about such predictions
”in absurdum” ?**



Only by extending the seismic database backwards via paleoseismology, are we able to assess future hazards in a meaningful way

The nuclear industry limits their analyses to seismology, fails in assessing the future risk correctly and produces directly misleading scenarios

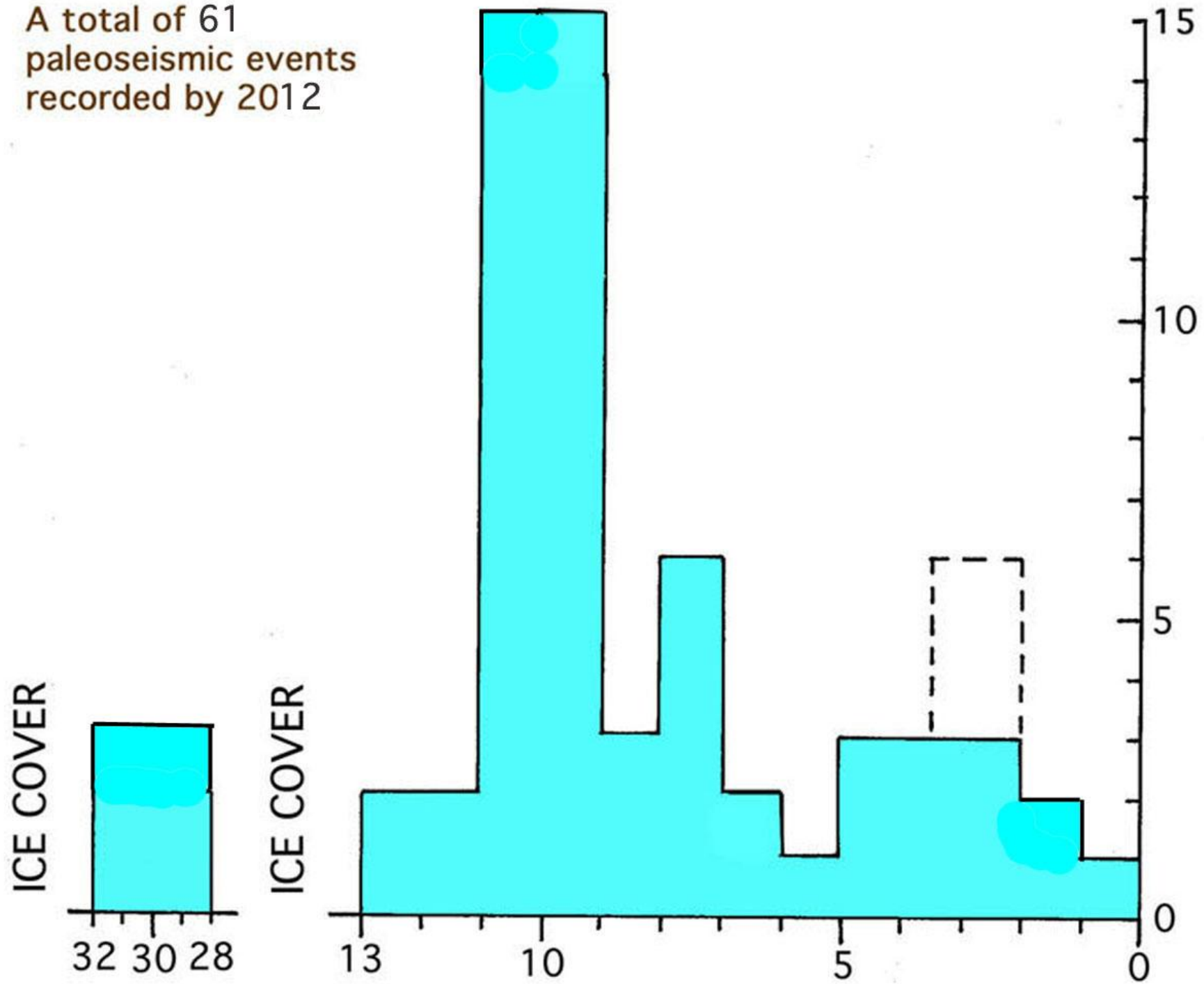
The Swedish-Finnish case

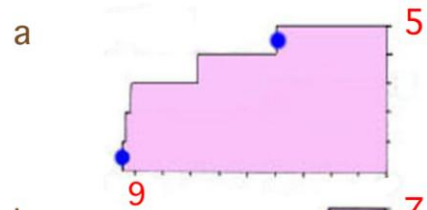
With increasing time units, the maximum earthquake magnitude increases dramatically; from below 4.8 to well above 8.

Seismology	<100 years	<4.8
Historical data	last 600 years	<5.5
Late Holocene	last 5000 years	>>6 to ~7
Deglacial phase	9–11 Ka BP	>>8

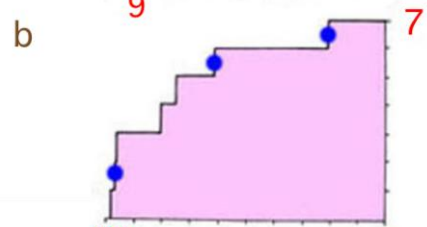
This implies that we can only achieve a meaningful long-term seismic hazard assessment, if the paleoseismic records of past earthquake events are included.

A total of 61
paleoseismic events
recorded by 2012

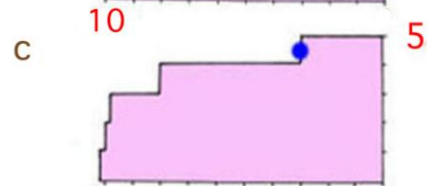




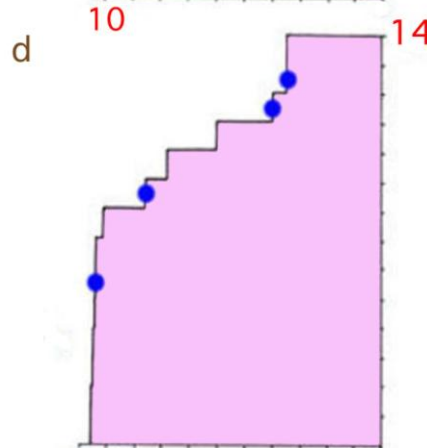
(a) 5 events in 9000 years (Umeå)



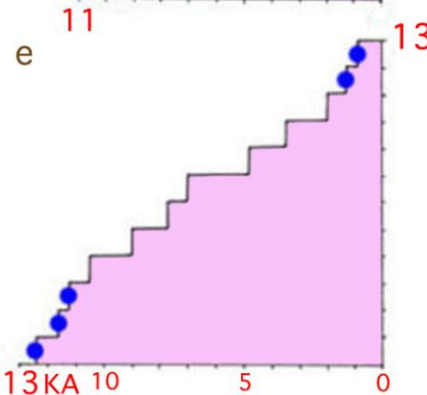
(b) 7 events in 10,000 years (Hudiksvall)



(c) 5 events in 10,000 years (Forsmark)



(d) 14 events in 11,000 years (Stockholm)



(e) 13 events in 13,000 years (Båstad)

As to paleoseismic magnitude, we have recorded the following distribution of our 61 events

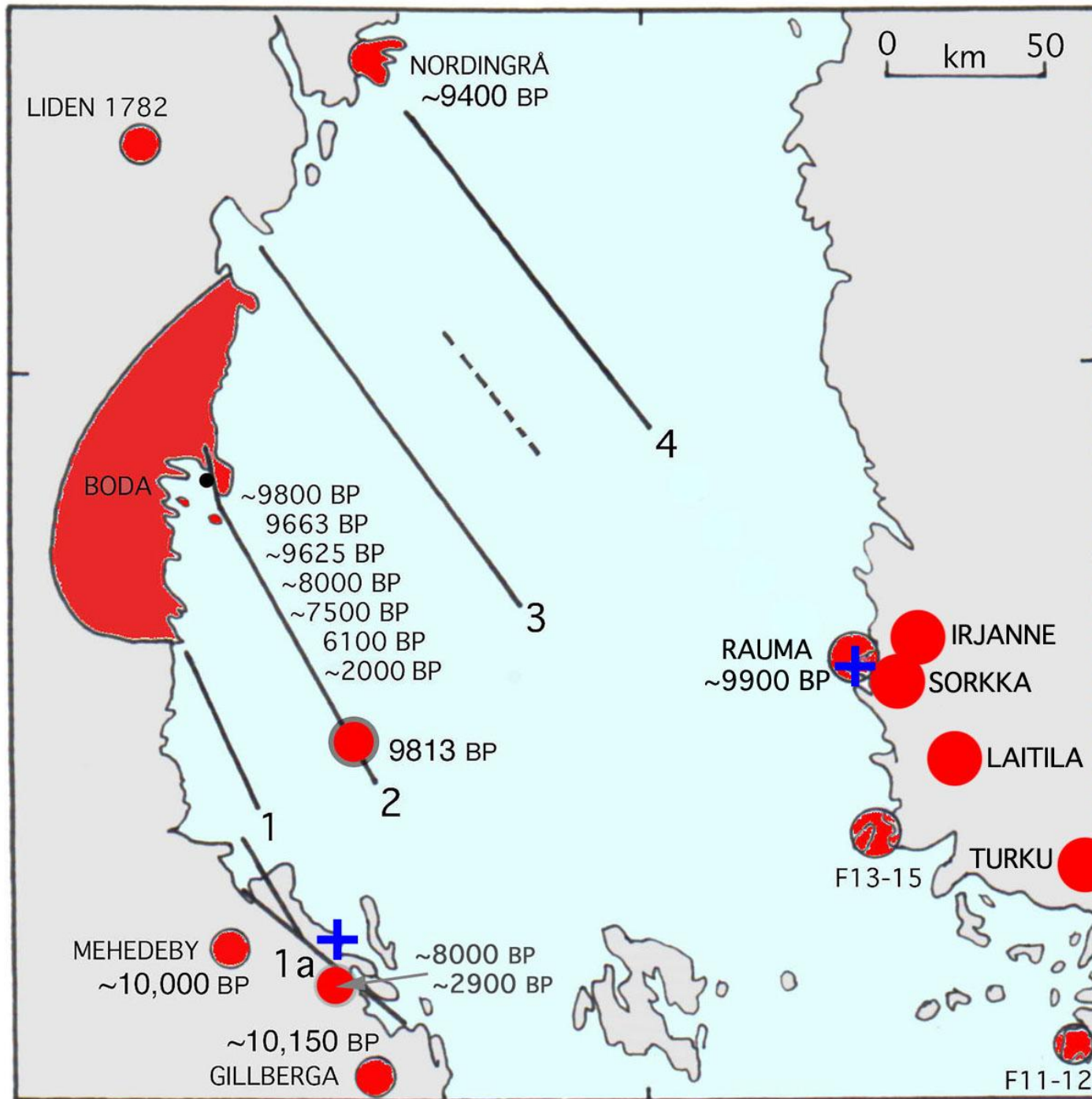
Magnitude	Number of events
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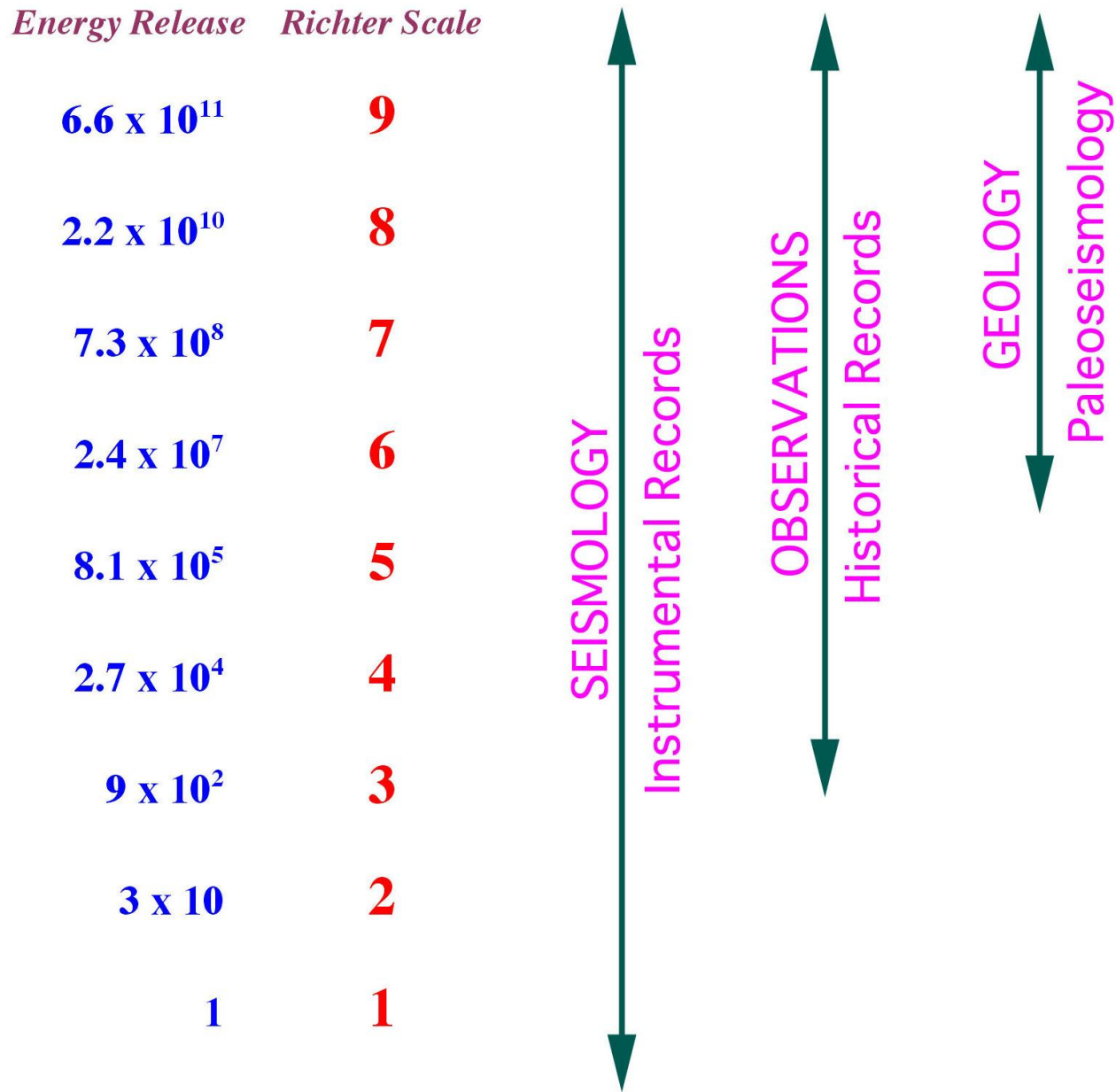
>8	7
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7–8	17
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6–7	30
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<6	7
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Paleoseismology records events of above M 5.5

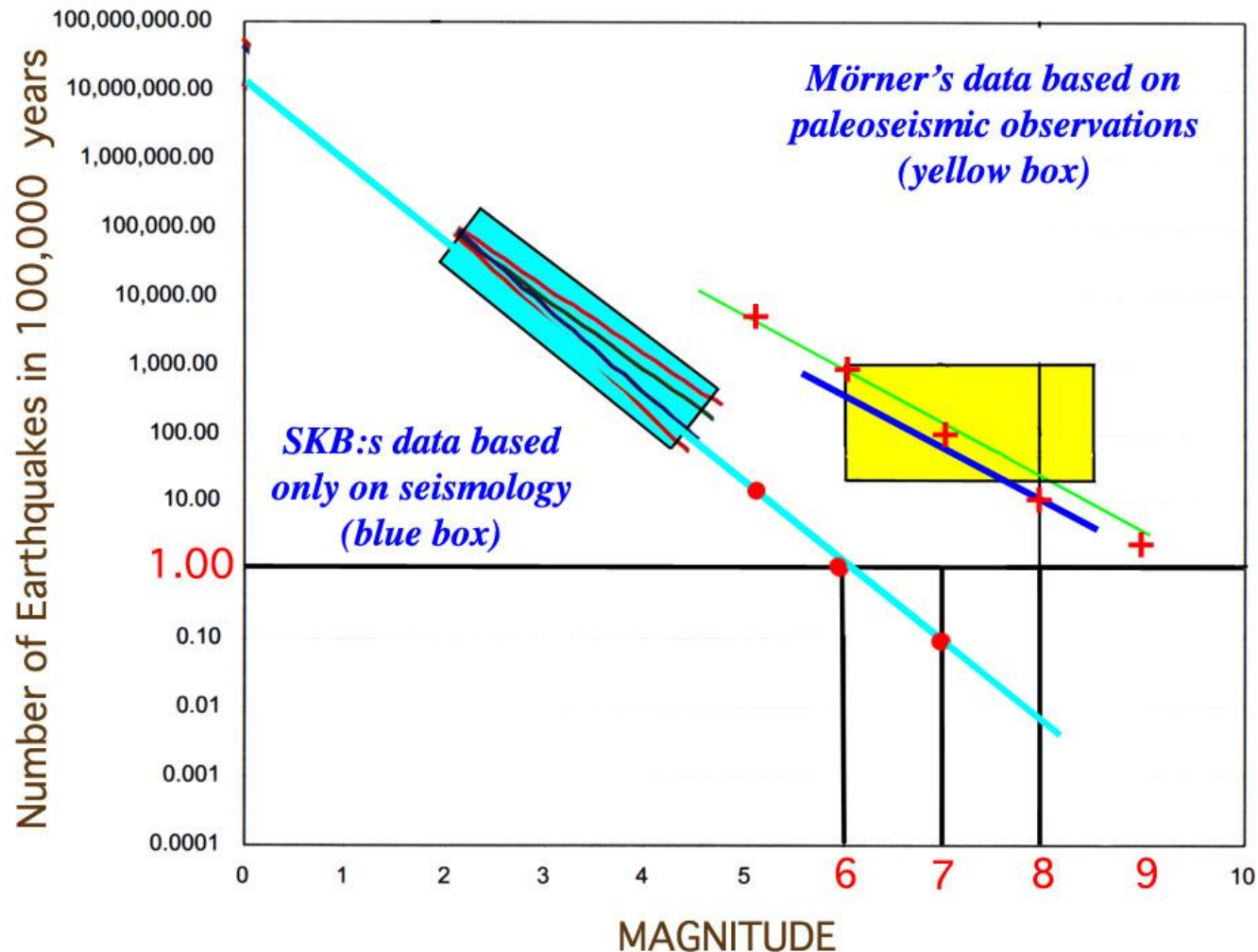
Seismic Hazard Prediction for the next 100,000 years

A: **Blue box** – based on seismic data only (SKB, Posiva)

max 1 M 6 event in 100,000 years

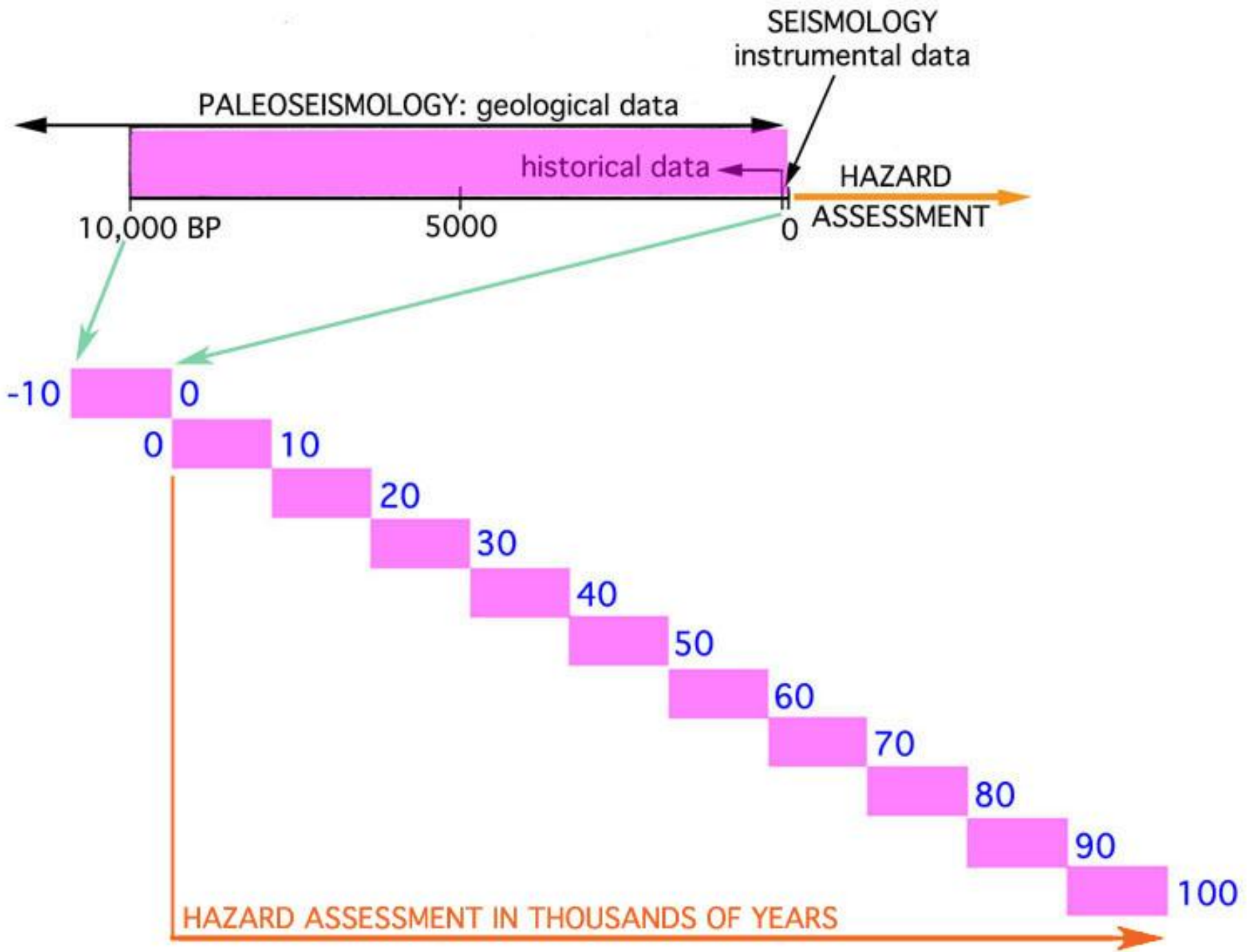
B: **Yellow box** – based on paleoseismic data (Mörner)

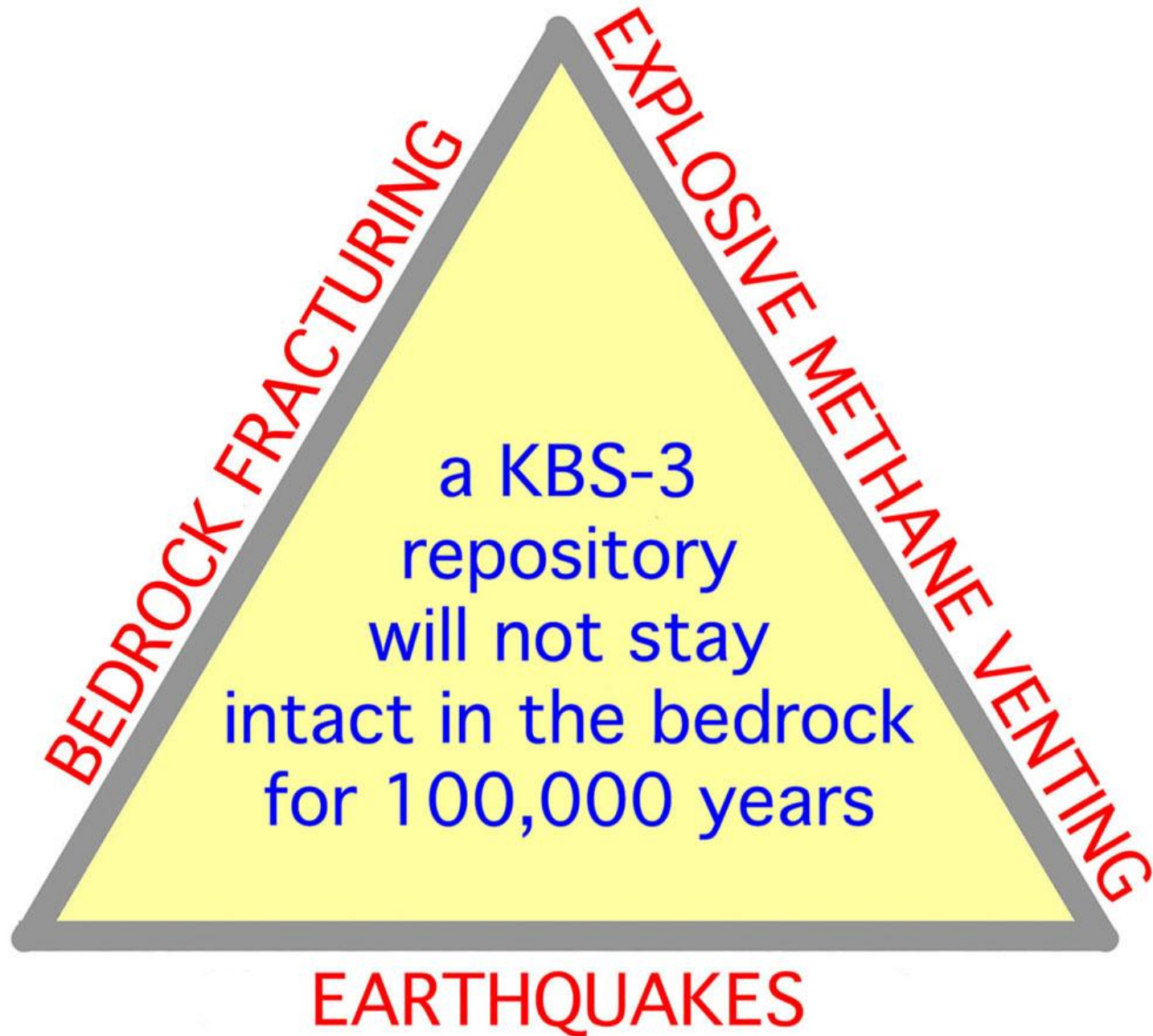
100–1000 M 7 events, ~10 M 8 events and even some M ~9 events



The long-term seismic risk is totally different – a repository would not survive

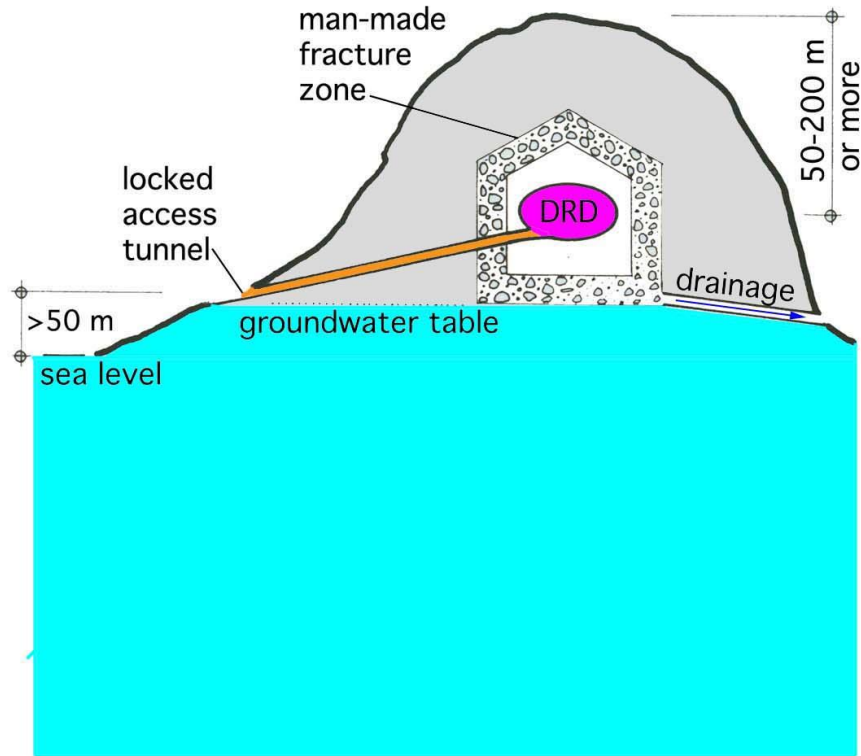
<i>Energy Release</i>	<i>Richter Scale</i>	<i>Earthquakes in Sweden</i>	<i>in Future 100,000 years</i>	
6.6×10^{11}	9	<p><i>Geologic database</i></p> <p>GEOLOGY</p> <p>paleoseismic field observations</p>		2-3
2.2×10^{10}	8			10
7.3×10^8	7		0,1	100
2.4×10^7	6		1	1000
8.1×10^5	5	<p>HISTORIC records (observations)</p> <p>SEISMOLOGY instruments</p> <p><i>SKB:s database</i></p>		1000 billion, times more seismic energy in yellow field
2.7×10^4	4			
9×10^2	3			
3×10	2			
1	1			





Dry Rock Deposit (DRD)

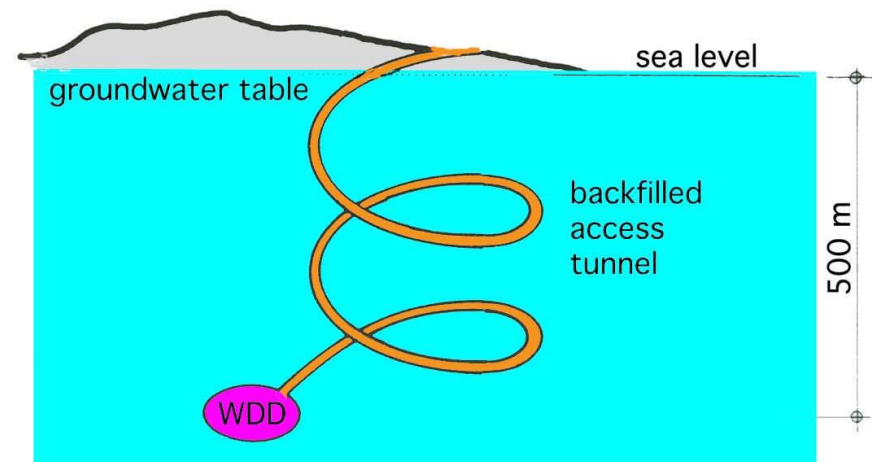
high relief area
far above sea level



Accessible and Controllable

Wet Deep Disposal (WDD) of KBS-3 type

low relief area
close to sea level



Closed and Final

References

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