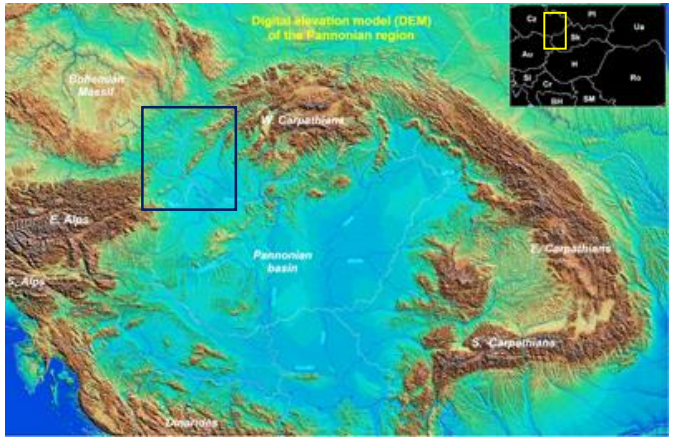
THE HISTORY OF THE HYDROCARBON EXPLORATION IN THE SLOVAK PART OF THE VIENNA BASIN

17. 10. 2019

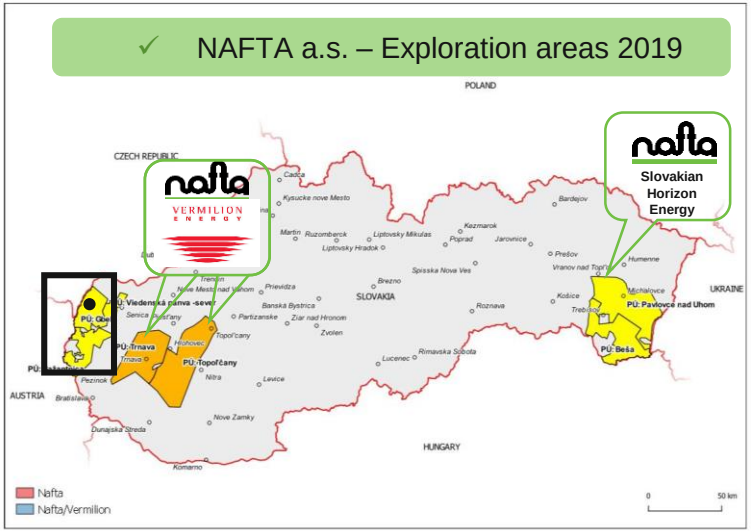
CONTENT

- **Exploration during Austro-Hungarian empire 1913 – 1918**
- **Exploration before and during second world war 1919 – 1945**
- **Exploration from 1945 to 70. years of last century**
- **Exploration to present time**

VIENNA BASIN



✓ NAFTA a.s. – Exploration areas 2019

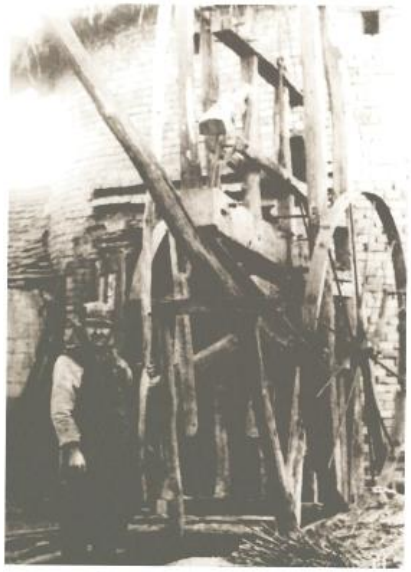


Exploration during Austro-Hungarian empire 1913 – 1918

JÁN MEDLEN DISCOVERER

Ján Medlen
(1870 – 1944)

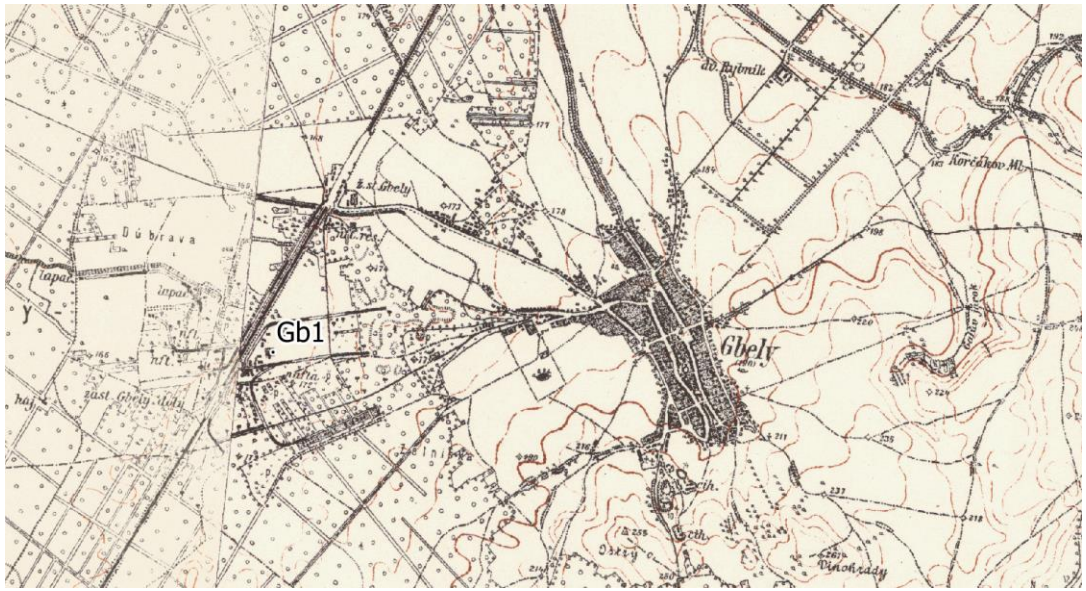
Ján a jeho opravená chyža



Ján Medlen park

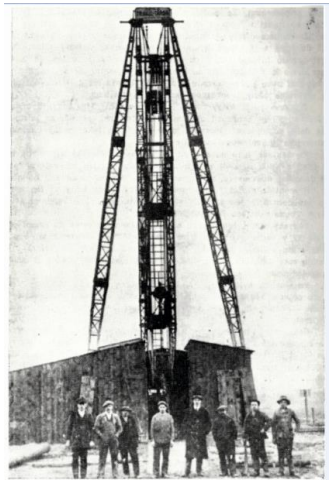
FIRST EXPLORATION

- S. Papp, H. Bockh provide structural and stratigraphic geological works in the 1913
- Result was identification shallow elevation structure ca 180 m from surface gas shows

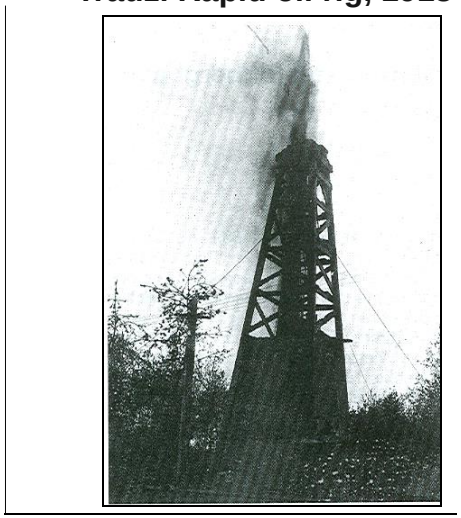


Gbely map 1920-1934

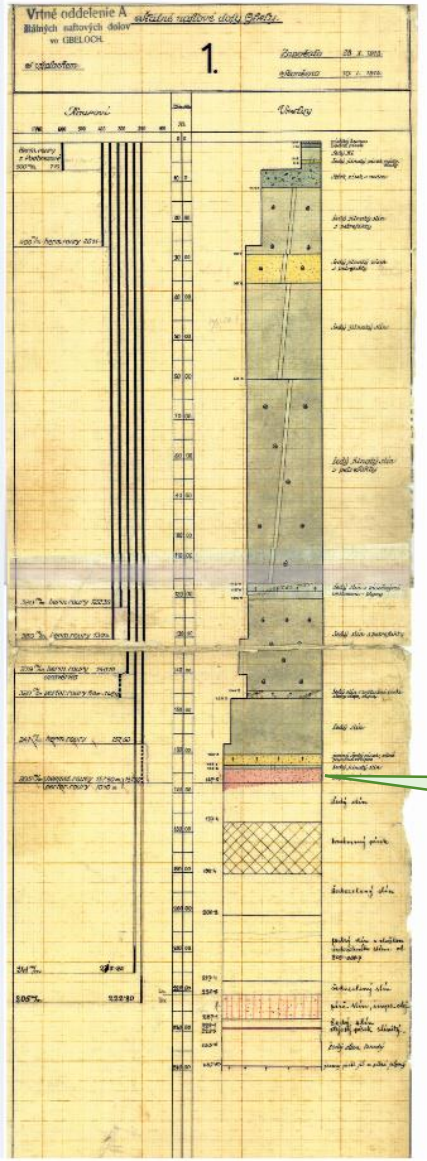
FIRST WELL GBELY 1



Trauzl Rapid oil rig, 1913



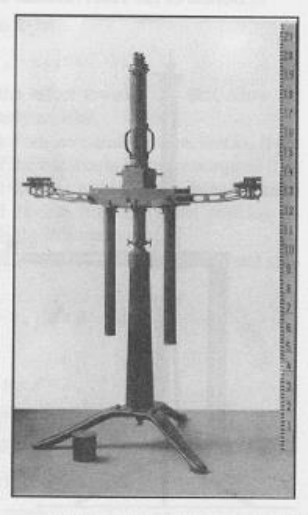
Egbell 1914, oil eruption

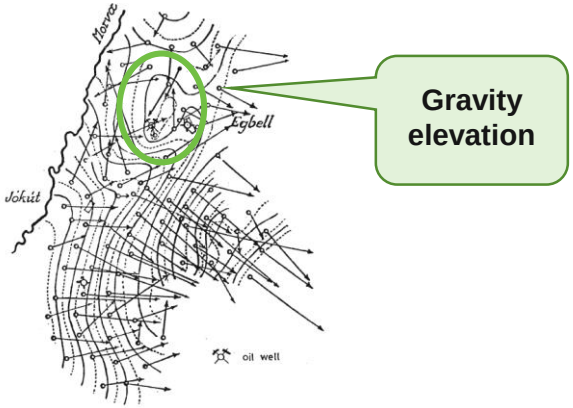


Oil horizon

- The first well Gbely 1, which was the very first well to be drilled on hydrocarbons in the Vienna basin was spudded 23rd October 1913 and encountered oil at the depth 164 m on the 31st December 1913.
- Production started on the 13th January 1914.
- Starting production was about 15 t/d
- The well was drilled by hand Trauzl Rapid rig
- It was the first commercial oil production well in Austro-Hungarian empire

EXPLORATION



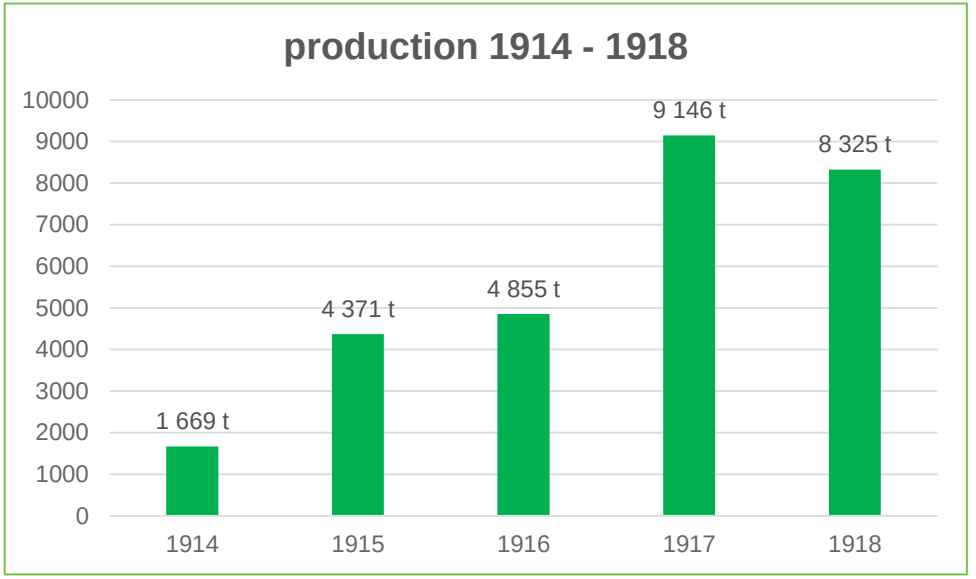


Gradient map of the Egbell test area, 1916

- In the 1916 H. von Bockh return to Gbely and provide measure by torsion weight. Results the measure independently identified the same elevation structure as was mapped out in the 1913.
- It was the first time when the gravity method was successfully used for proving the presence of hydrocarbon bearing structures.
- Main exploration methods were identification surface hydrocarbon occurrence and shallow structural and stratigraphic works

PRODUCTION

- During the years 1914-1918 was drilled 56 wells and the first oil field „Staré pole“ (Old field) was discovered
- The wells produced oil mainly by natual flow, some by bailing
- Total production during the years 1914 – 1918 was **29 362 t of oil.**
- About 400 employes worked in oil company



02

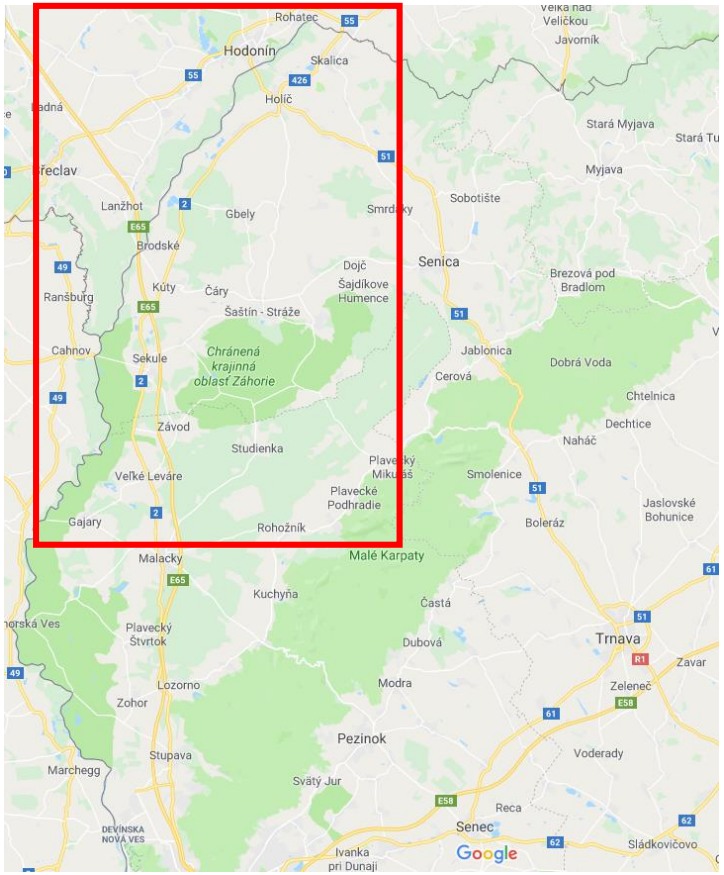
Exploration before and during second world war 1919 – 1945

EXPLORATION

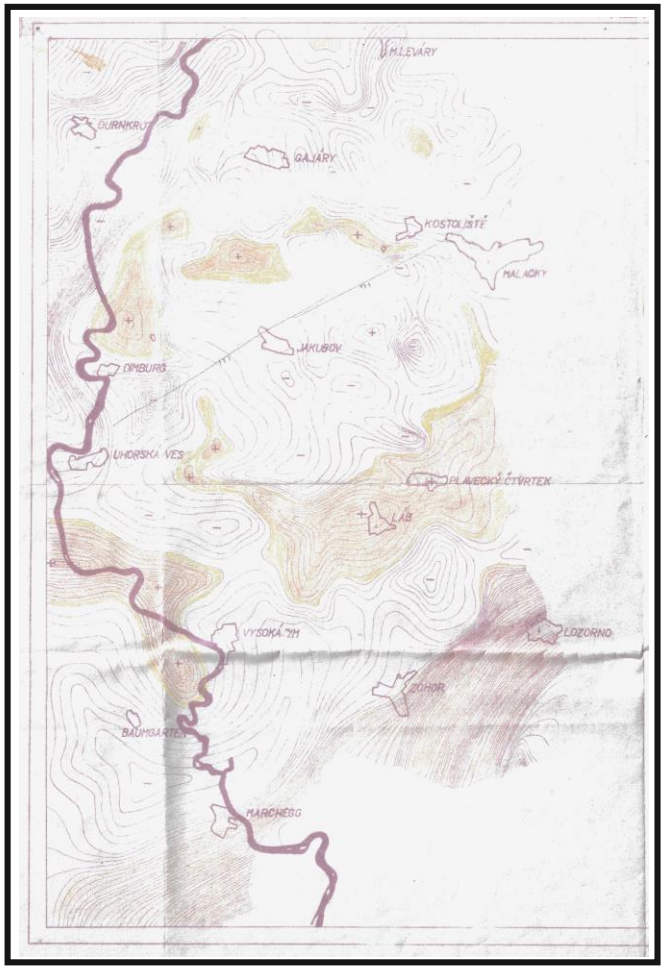
- Exploration in the first half of 20th years was performed mainly based on oil&gas seepage on the surface and occurence hydrocarbons in the water wells and shallow exploration wells drilled up to 200 m.

- Geophysical methods start to be implemented to exploration
  - 1926 – 1927 geoelectric measure Sundberg method (swedish american company AEM)
  - Gravity measure – indicate elevation structure in the vicinity of Gbely
  - 1939 – 1945 first seismic measure (refraction) Germany company Gesellschaft fur praktische Lagerstättenforschung
  - Well log measure (Schlumberger) SP and RaG implemented to wells (1942) which brings significant improvement in oil&gas horizons identification

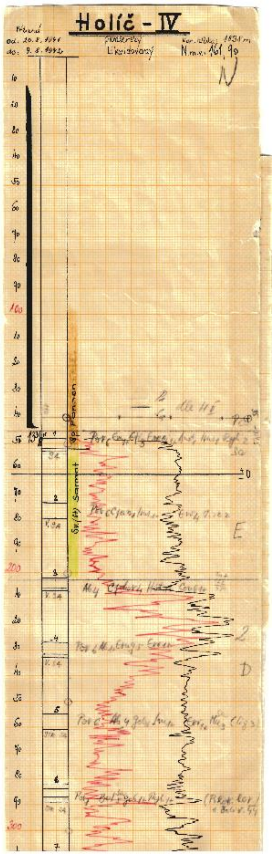
- Exploration works expanded from Gbely area to other Vienna Basin parts like Šaštín, Brodské, Závod, Kuklov, Gajary and pioneers wells were drilled up to 1 000 m.



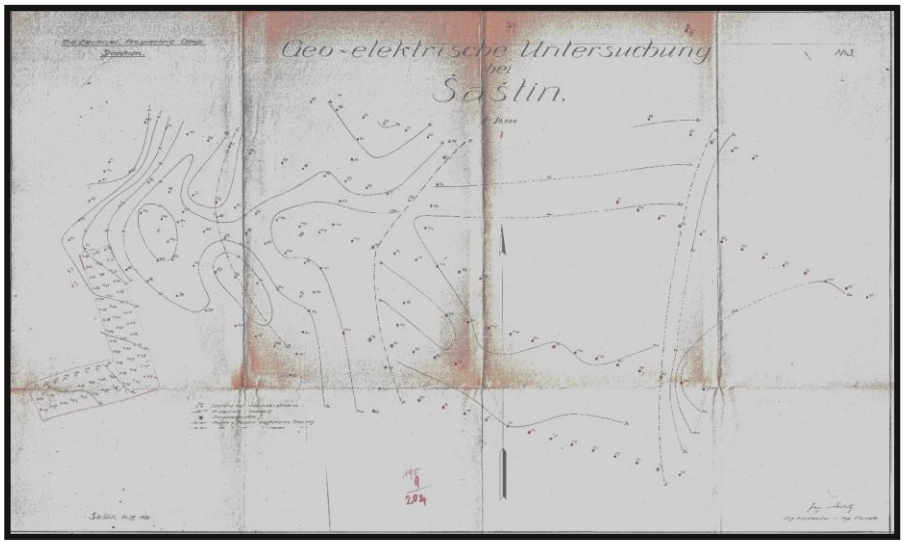
EXPLORATION



Seismic measure
1942



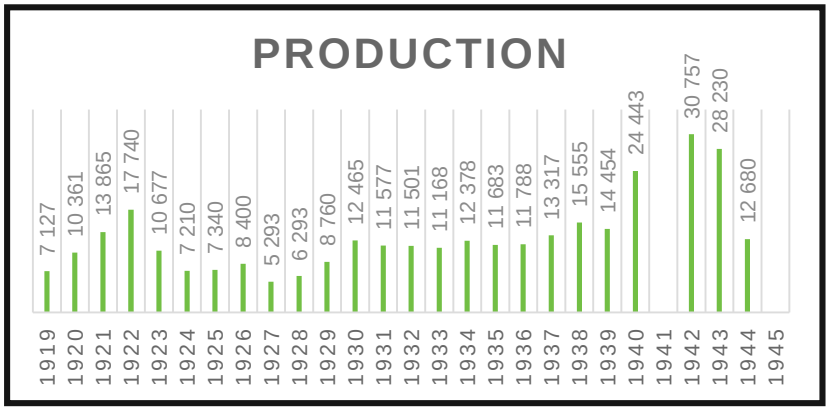
Well Log measure (SP, RaG)
1942

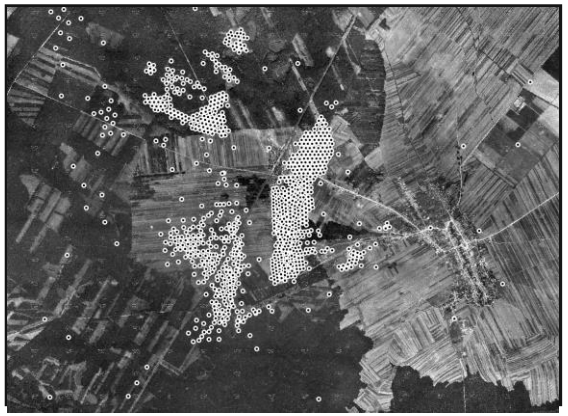


Geoeletric measure Sundberg
methods 1926

PRODUCTION

- All oil production was from Gbely fields
- In the vicinity of Gbely was discovered 6 oil fields
  - Staré pole (Old field) 1914
  - Nové pole (New field) 1927
  - Cigánske pole (Gipsy field) 1939
  - A pole (A field) 1942
  - Farské pole (Farské field) 1943
  - B pole (B fields) 1967
- In Gbely oil fields was drilled more then 800 wells
- Total production in Gbely fields was 844 748 t of oil





Gbely aerial photo 1950

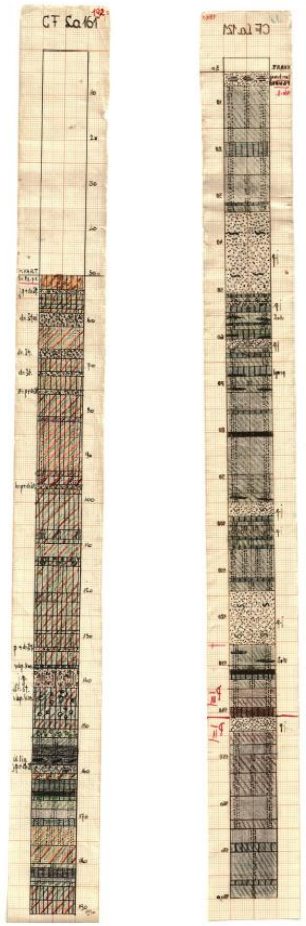
03

Exploration from 1945 to 70. years of last century

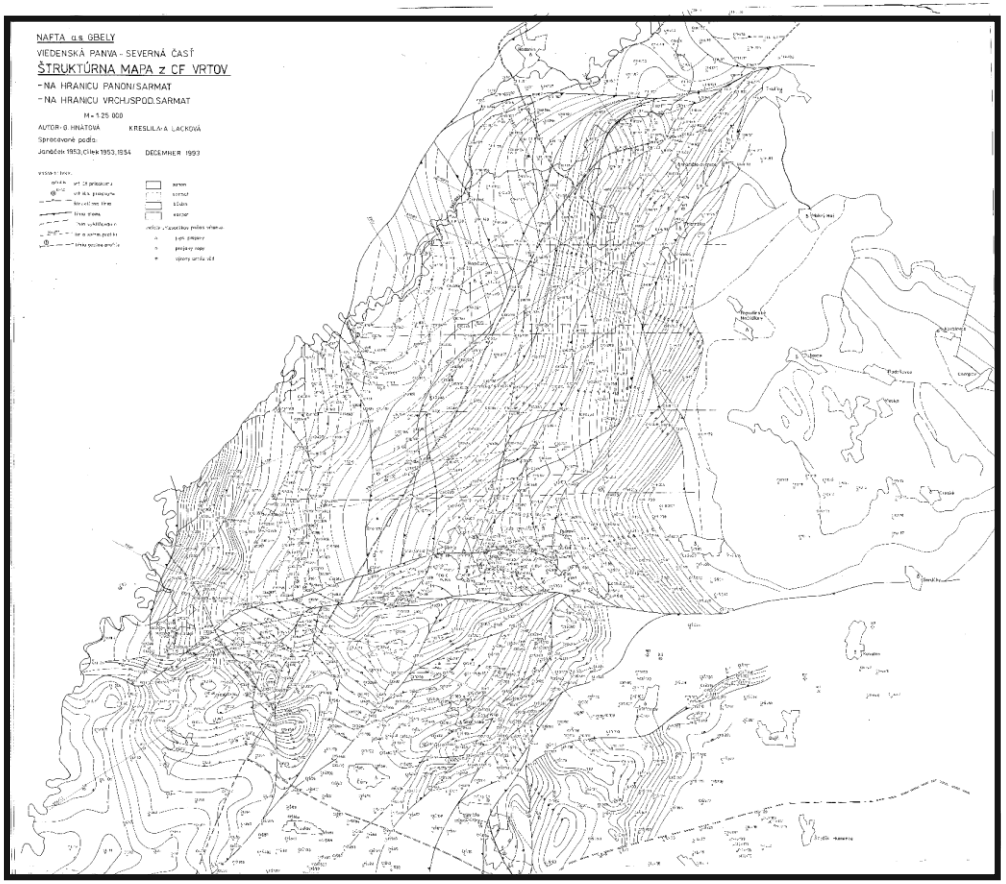
EXPLORATION

- Exploration after 1945 performed mainly based on drilling exploration wells and geophysical measure.
    - **Cf wells** (over 2 000 wells), 300/600 m depth, contiune coring, no logging, first shallow structural maps of Vienna Basin
    - **Exploration wells** drilled based on CF wells and interpretation of geophysical measure
- Geophysical methods
    - **Gravity&magnetometry** measure carry out in scale 1:50 000 in all area of Vienna Basin
    - **seismic measure** analogue reflection&refraction measure covered all Vienna Basin
    - **Well log** measure mainly SP and RaG began standard of the well evaluation.
- Exploration works covered all area of Vienna Basin and enable to discovery the main structural oil&gas fields.

EXPLORATION – CF WELLS

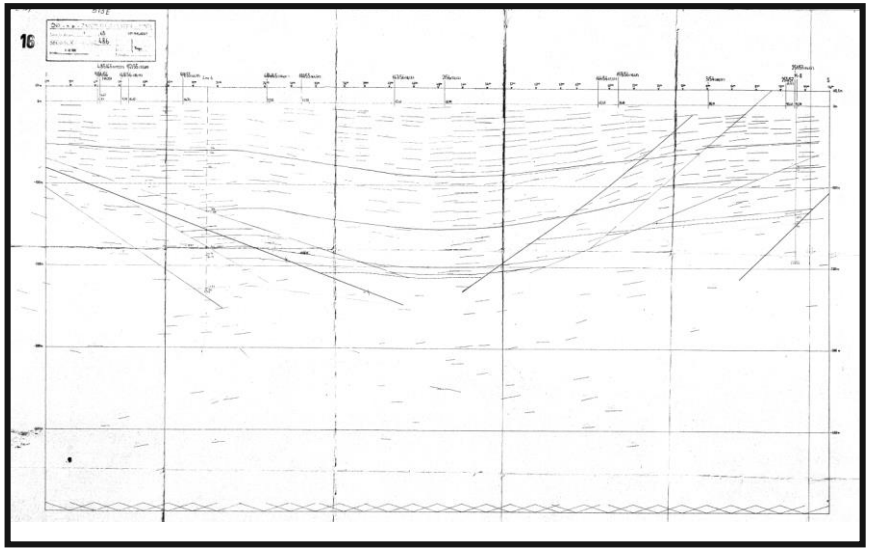


CF wells

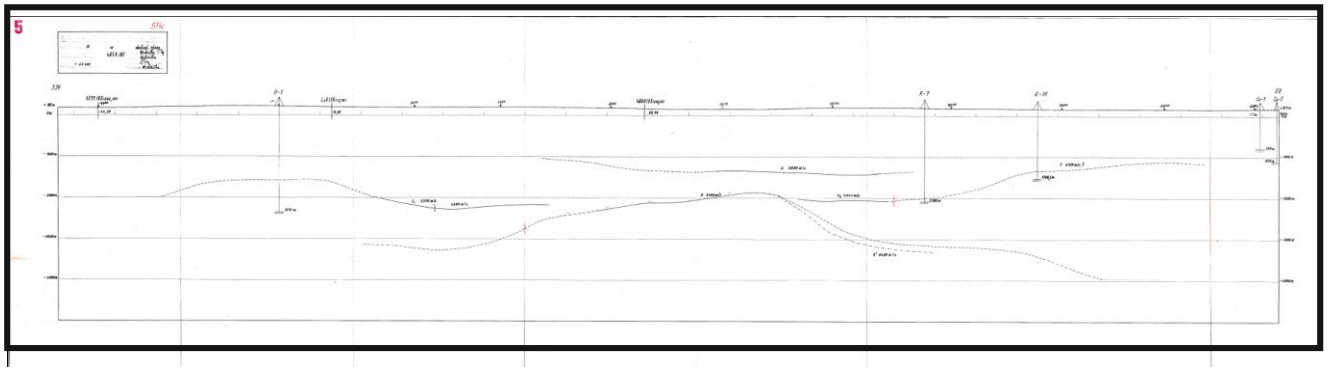


CF wells map

EXPLORATION – SEISMIC

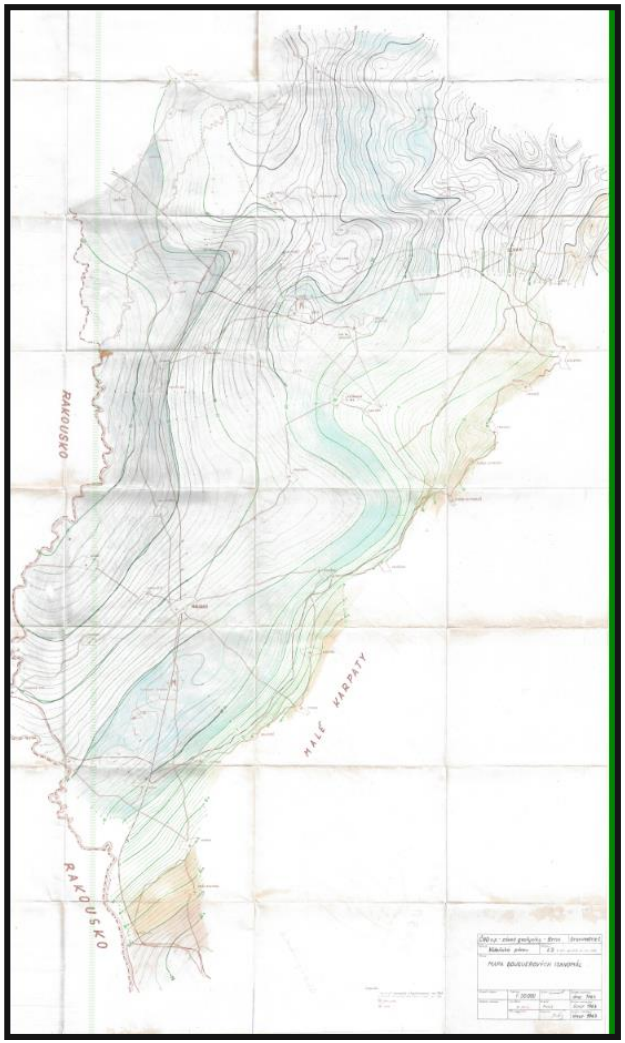


analogue reflection seismic profile

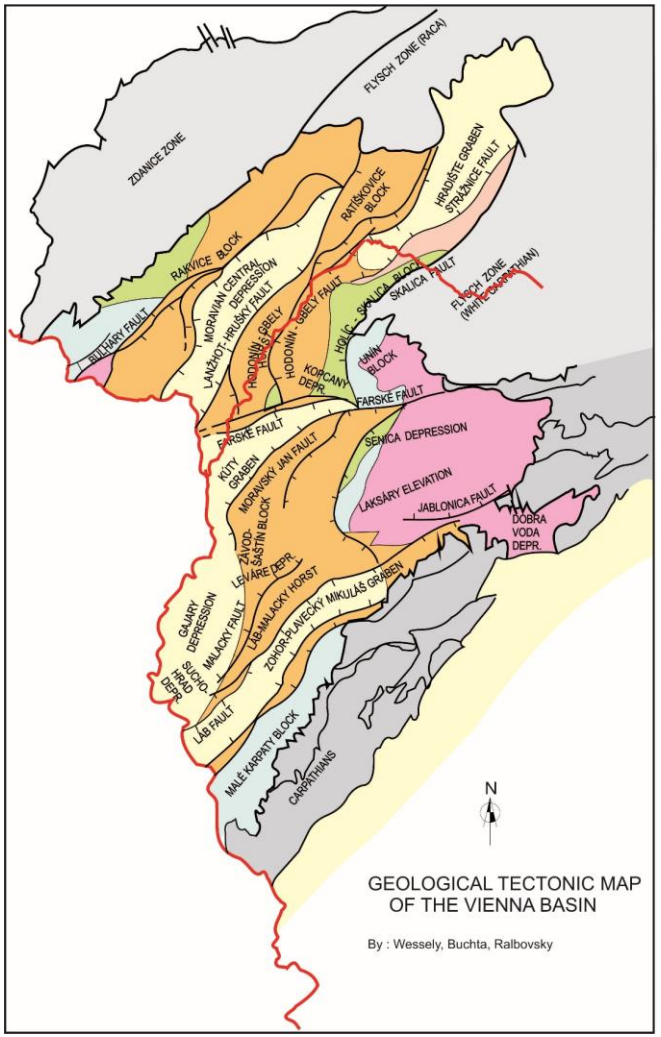


analogue refraction seismic profile

EXPLORATION – GRAVITY

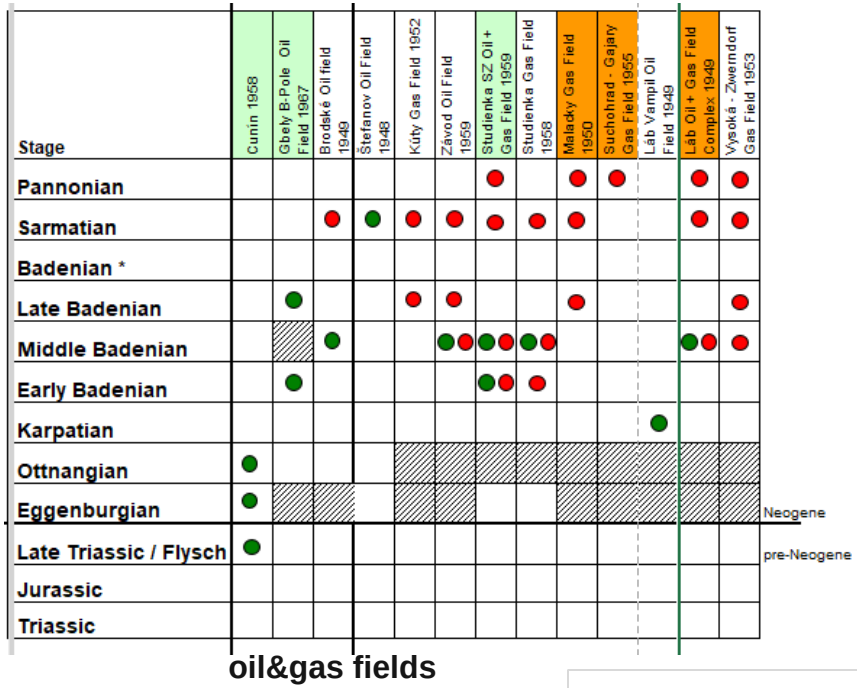


bouguer anomaly map 1962



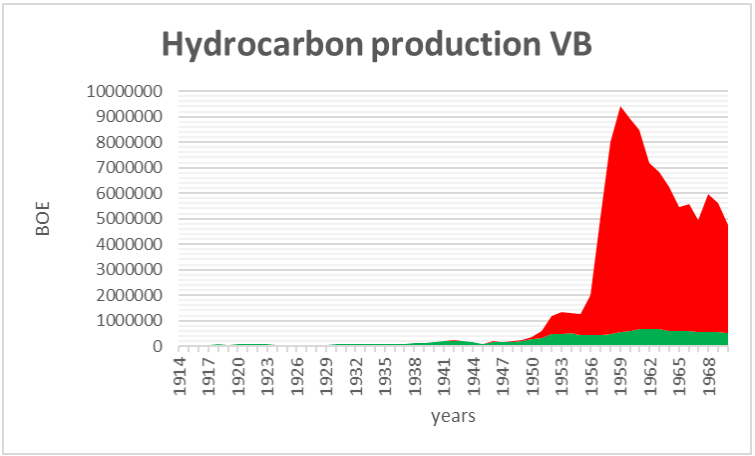
Vienna Basin structural map

FIELD DISCOVERY, PRODUCTION



oil&gas fields

- During the years 1945 – 1970 were discovered almost all major neogene structural traps
- Field were discovered in all stratigraphic units including pre-neogene basement
- It was discovered the biggest gas field in the Middle Europe Vysoka-Zwerndorf with reserves 30 bln m3 of gas.
- Gas production in 1960 reach the peak more then 1 lbn m3 of gas



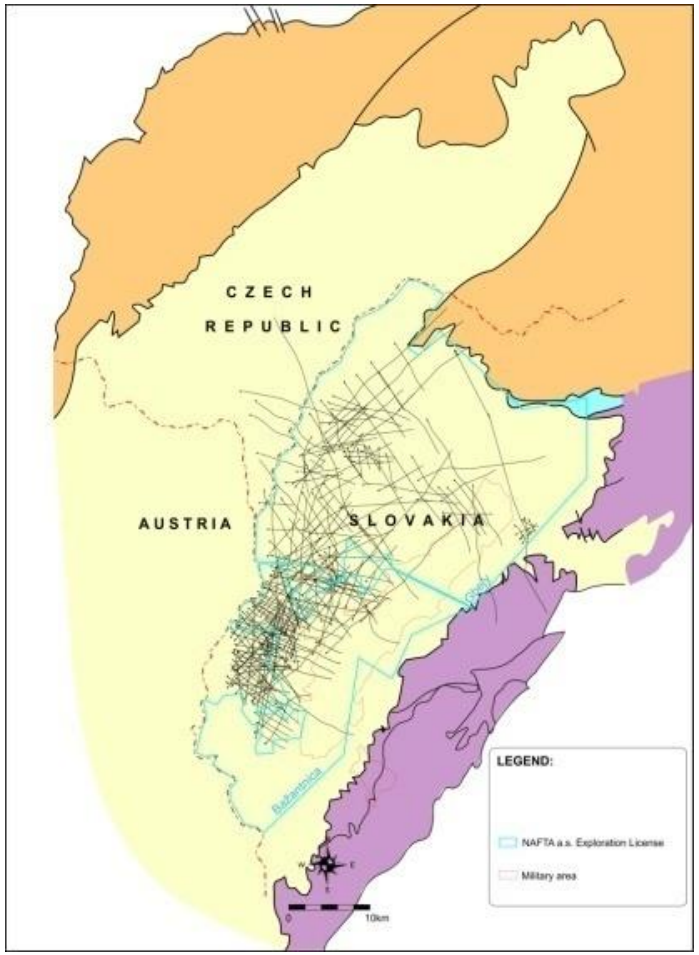
04

Exploration to present time

EXPLORATION

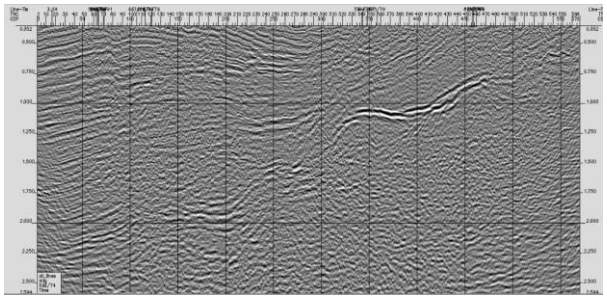
- Exploration provide mainly based on interpretation geophysical data especially 2D/3D seismic data.
    - **1972** implementation digital seismic technology CDP method
    - **1978** seismic processing with RAP (relative amplitu preservation)
    - **80. years** basic seismic attribute (reflection strenght, instantaneous frequency, instantaneous phase)
    - **1988** the first 3D seismic measure in Vienna Basin - 3D Závod (88 sq. km)
    - **90. years** implementation AVO analysis
    - **90. years** seismic and sequence stratigrahpy technique application
    - **2004** risk analysis and risk economical evaluation implemented.

EXPLORATION – 2D SEISMIC

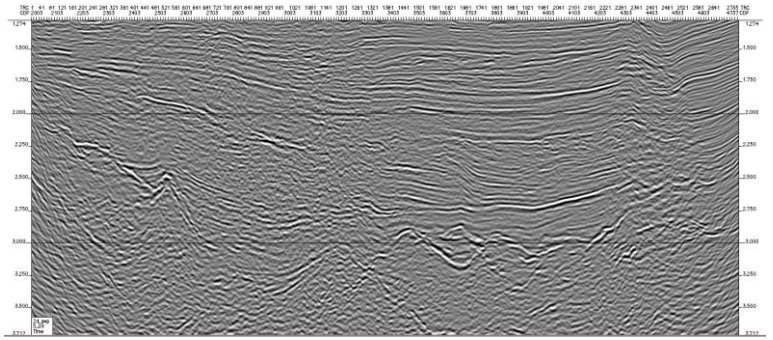


2D seismic coverage

- 1972 - 2009 168 2D seismic profiles acquired with the lenght about 1 793 km.
- CDP step from 40 to 10 m
- Fold from 6 to 240

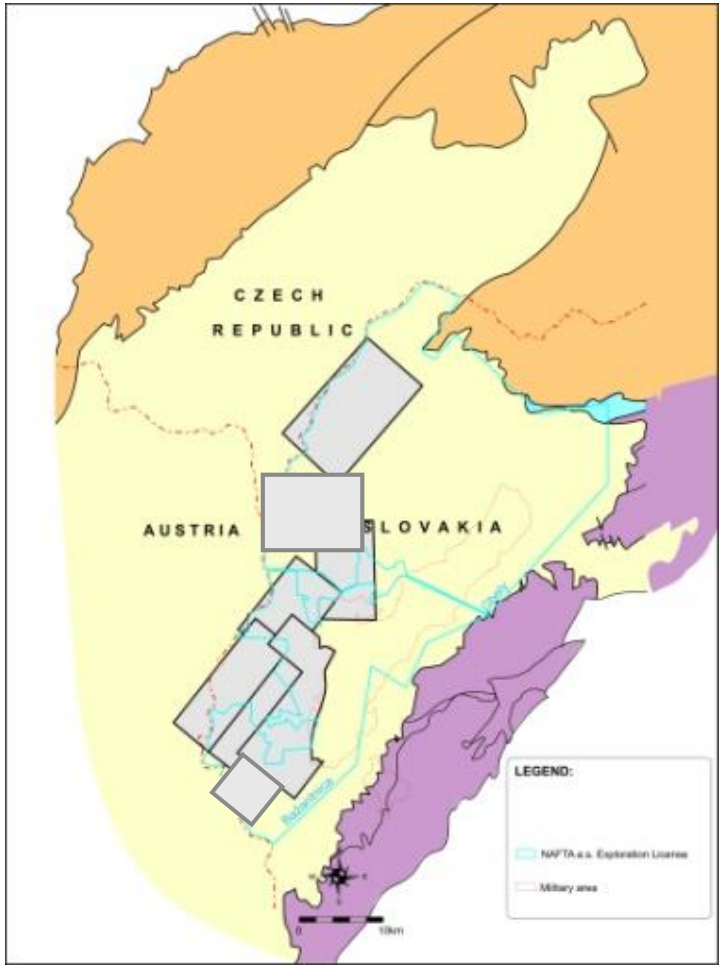


2D seisimic 1974, fold 6



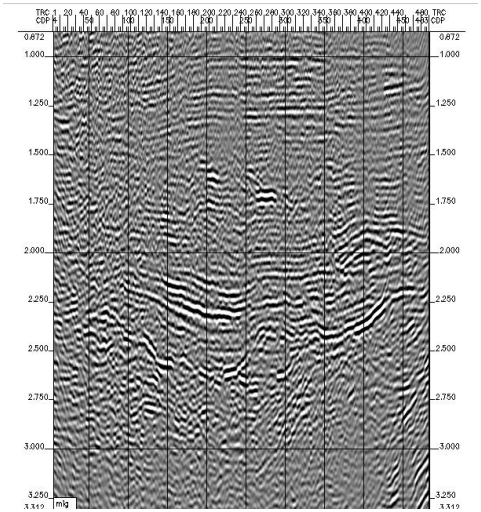
2D seisimic 2009, fold 240

EXPLORATION – 3D SEISMIC

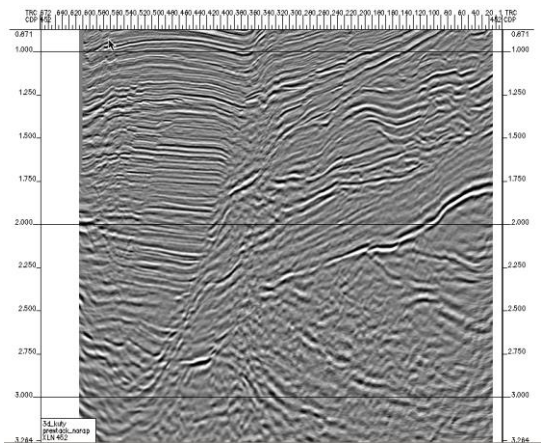


3D seismic coverage

- 1988 - 2014 9 blocks of 3D seismic acquired with total acreage 747 sq. km.
- Bin size from 40x40 to 20x20 m
- Fold from 12 to 60

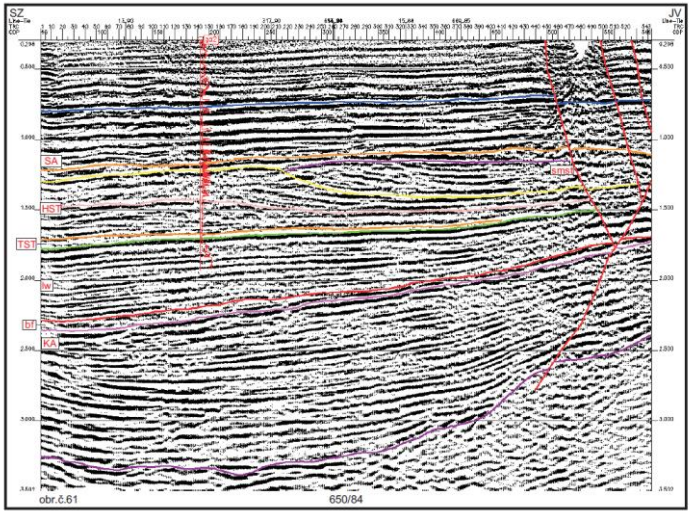


3D seismic 1988, fold 12

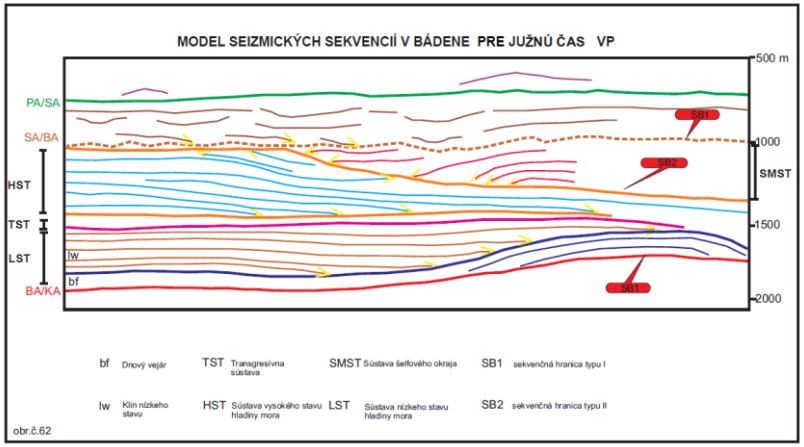


3D seismic 2014, fold 60

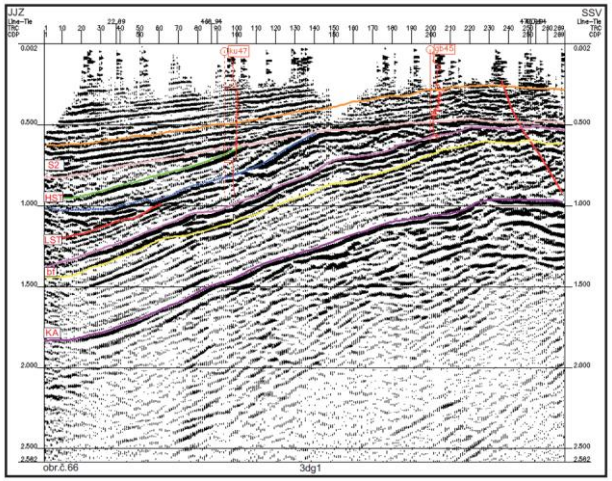
EXPLORATION – SEISMIC & SEQUENCE STRATIGRAPHY

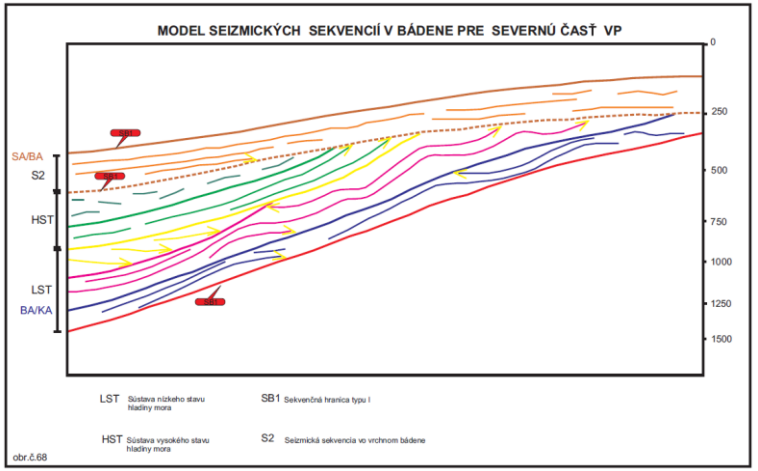


seismostratigraphic interpretation

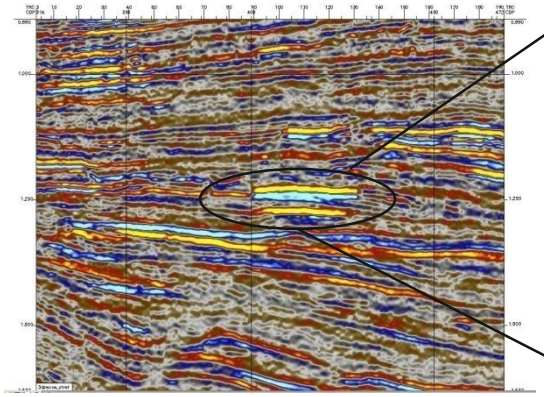


sequence stratigraphy model

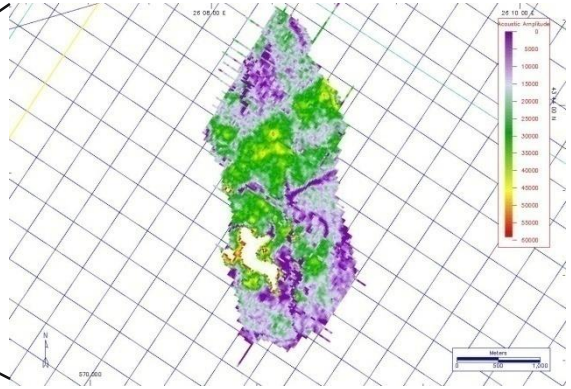




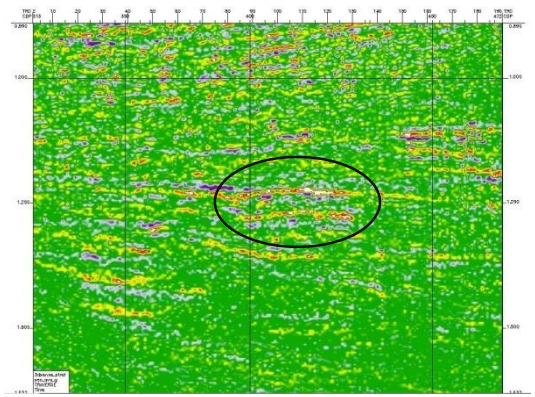
EXPLORATION – DHI



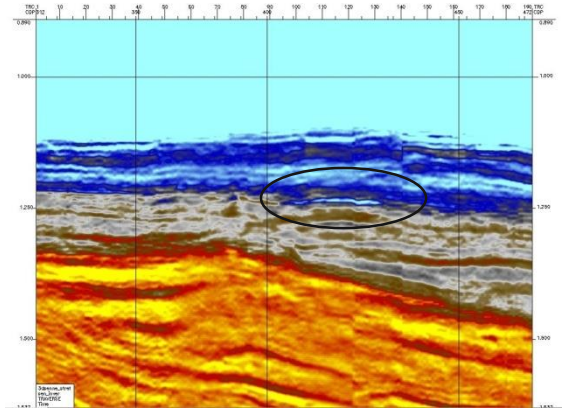
bright spot on 3D seismic data



Amplitude map of bright spotu

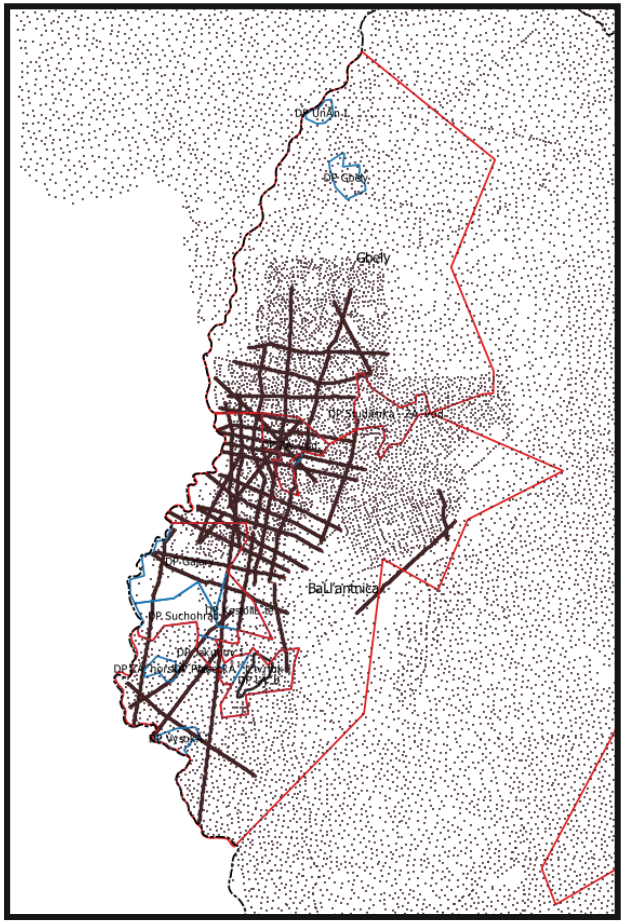


AVO anomaly

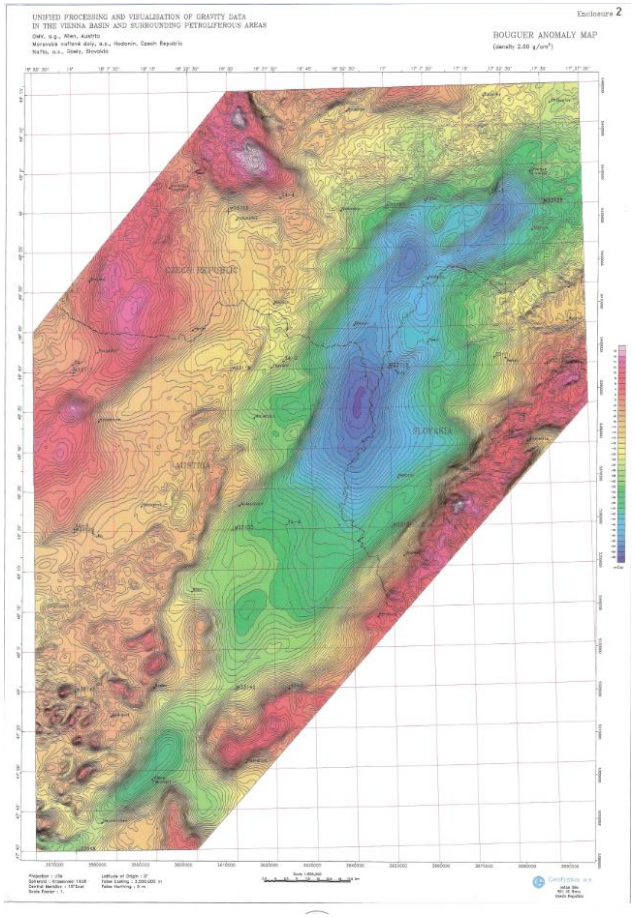


Inversion seismic

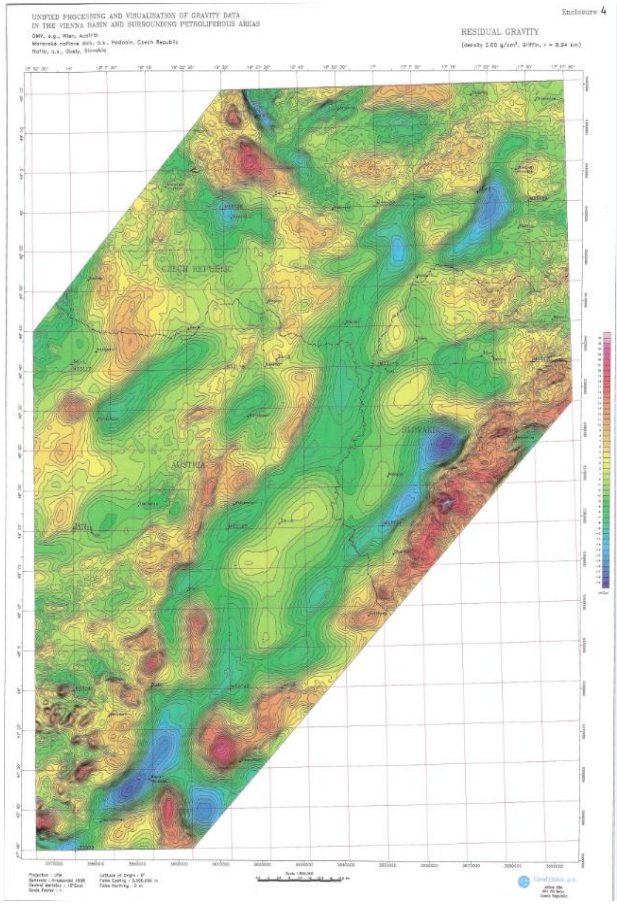
EXPLORATION – GRAVITY



Gravity measure coverage

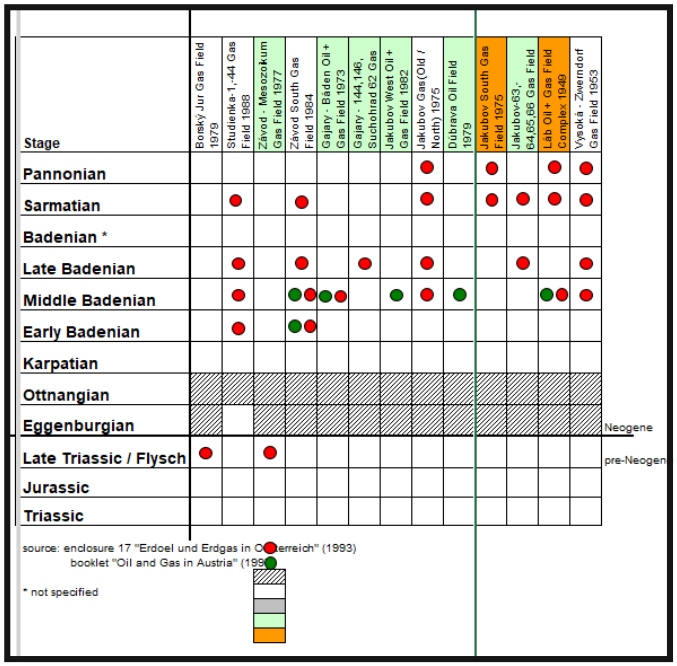


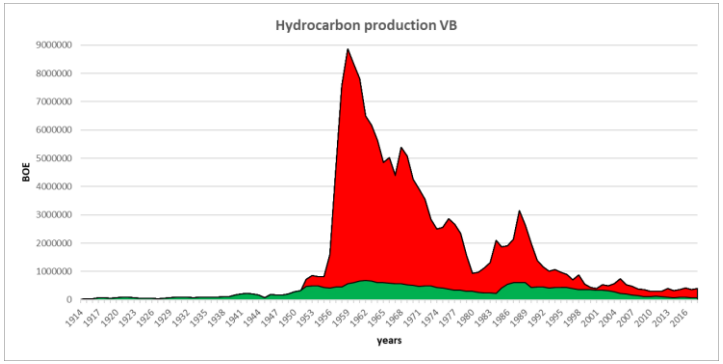
bouguer anomaly map



residual gravity map

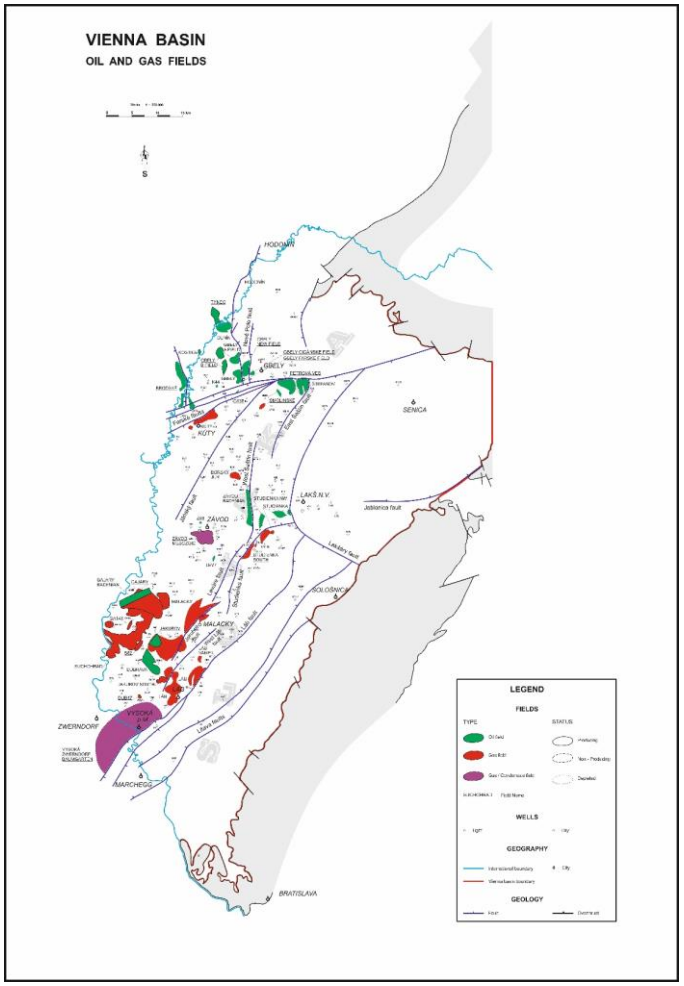
PRODUCTION





- During the years 1970 – 2019 were discovered mainly fields representing stratigraphic traps
- Two fields were discovered in pre-neogene basement – Northern Calcareous Alp napes
- The biggest stratigraphic trap was discovered, oil&gas field Gajary Baden. Production about 890 ths. t of oil.
- Second peak of gas production reached in 1988 about 690 mil. m3 of gas

CONCLUSION



- **Present time 26 oil and gas field have been discovered in Slovak part of Vienna Basin**
- **12 produced gas**
- **10 produced oil**
- **4 are oil and gas producer**

Production levels

	until 2018
Natural gas	*26.9 bil. m^3*
Crude oil	*3.85 mil. t*
Condensate	*440 ths. tonnes*

Sources:

1. Z dejín ťažby ropy a zemného plynu na Slovensku, zborník prednášok, 2001
2. Archive NAFTA a.s.
3. Mineralia Slovaca, ročník 6, č.5-6, 1974
4. M. Čársky: Ján Medlen 1870-1944,
5. Naftový prúmysl na území Československa, Nafta s.p. publikácia, 1983
6. Mesto Gbely, 2012

THANK YOU FOR ATTENTION