MSc REM
INDIVIDUAL PROJECT

Faults transmissibility assessment for terrigenious reservoir of K oilfield

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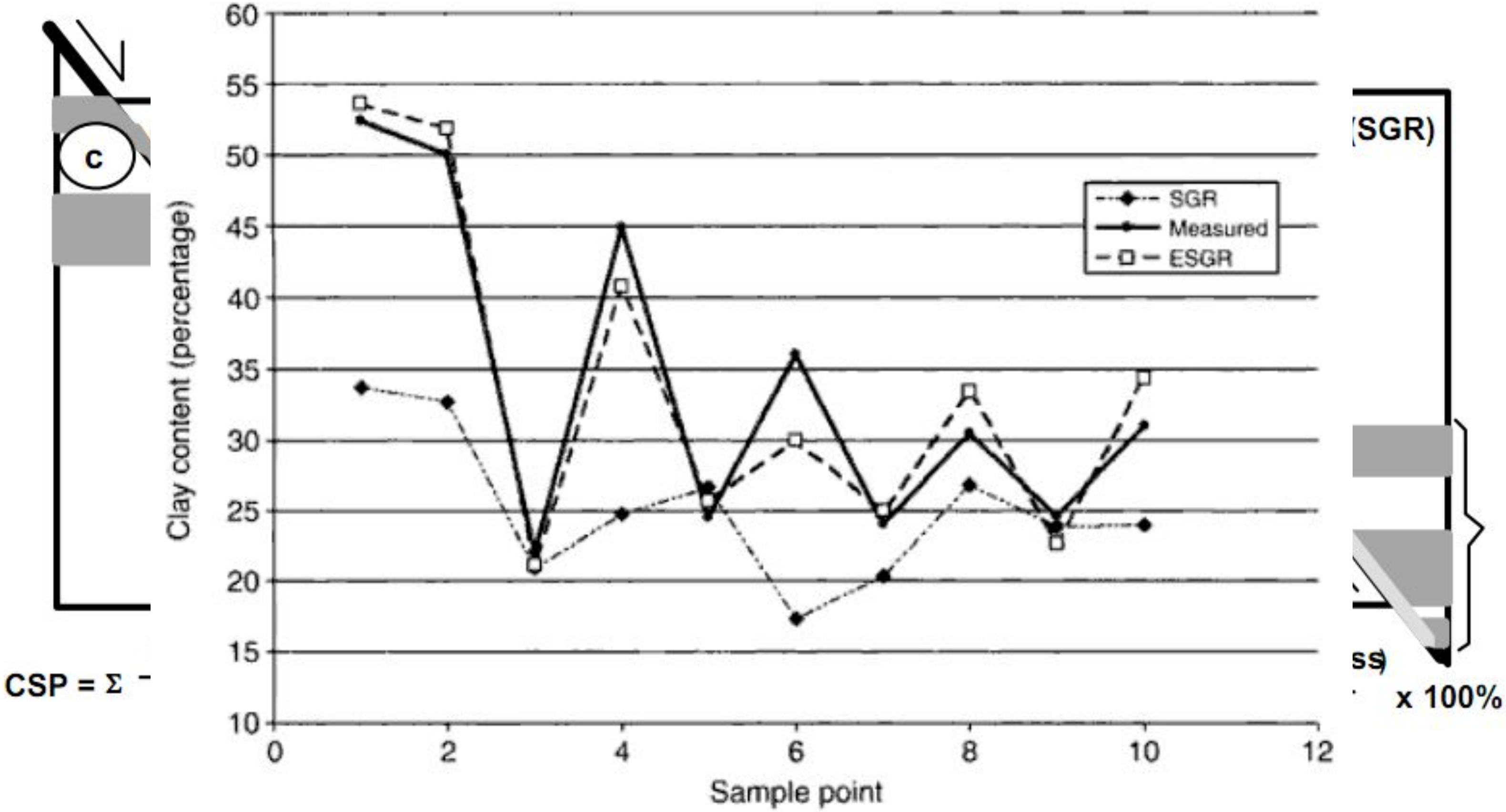
Main aims:

- Faults transmissibility calculation by different techniques.
- Choosing the most applicable calculation technique for transmissibility assessment.
- Recognizing dependences between fault geometry, reservoir basic properties and fault transmissibility for practical use.

Main objects:

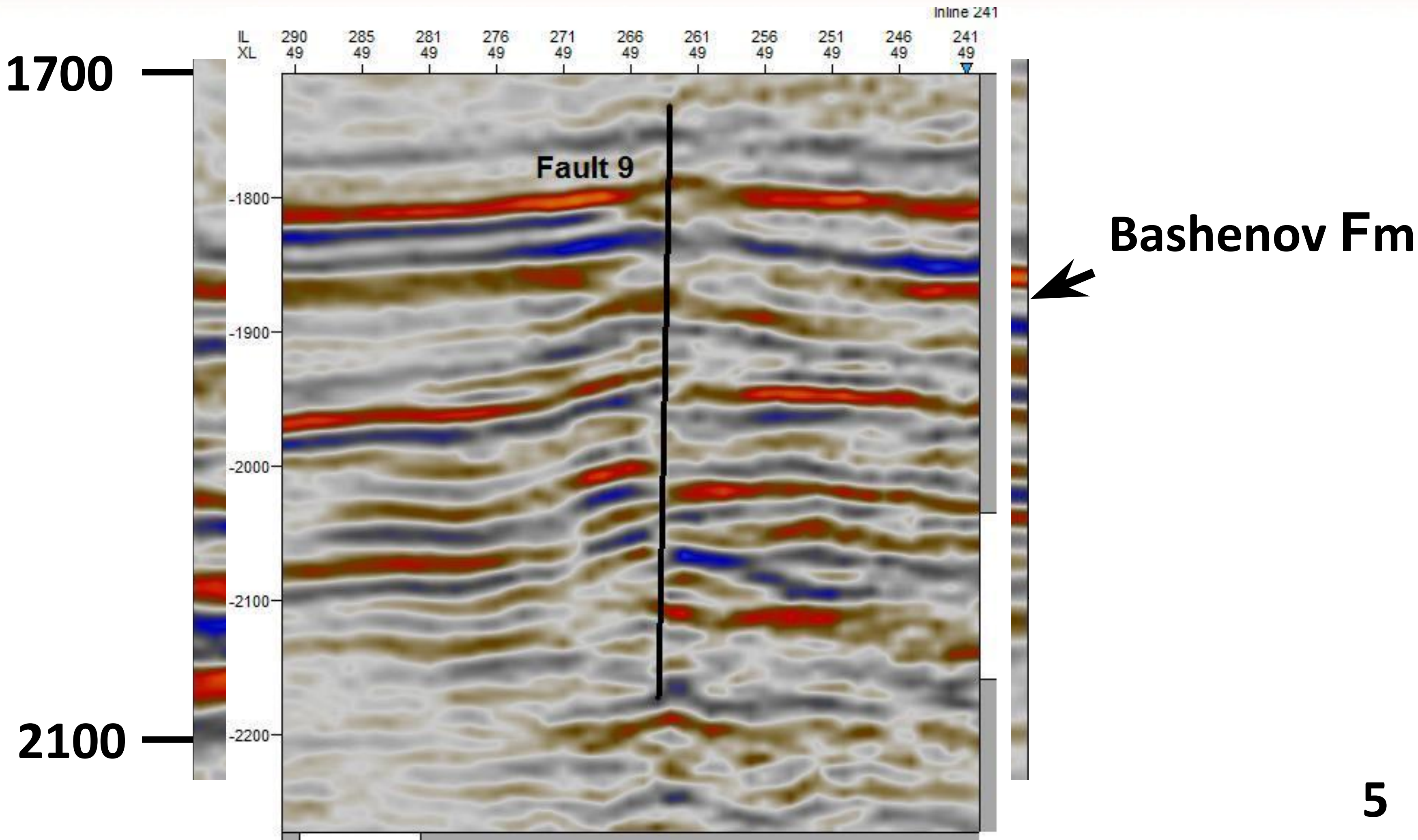
1. Recognizing approved techniques for fault transmissibility assessment.
2. Fault throw calculation.
3. Geomodelling and transmissibility assessment by selected techniques.
4. Choosing the best techniques by history matching and fluids contact level analysis.

1. Approved techniques search

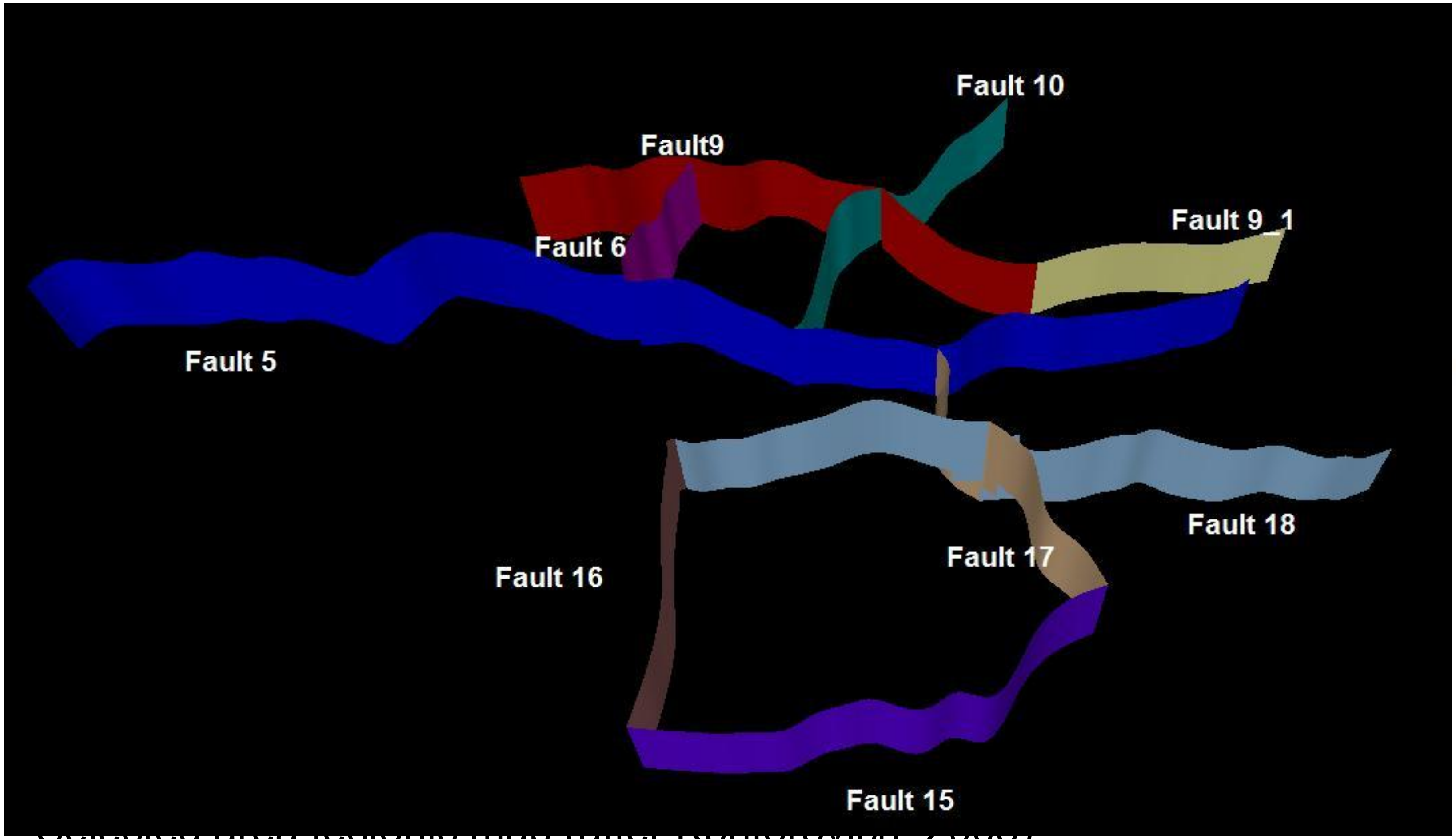


Fault seal mapping (Freeman et al., 2008)

2. Fault throw calculation



2. Fault throw calculation



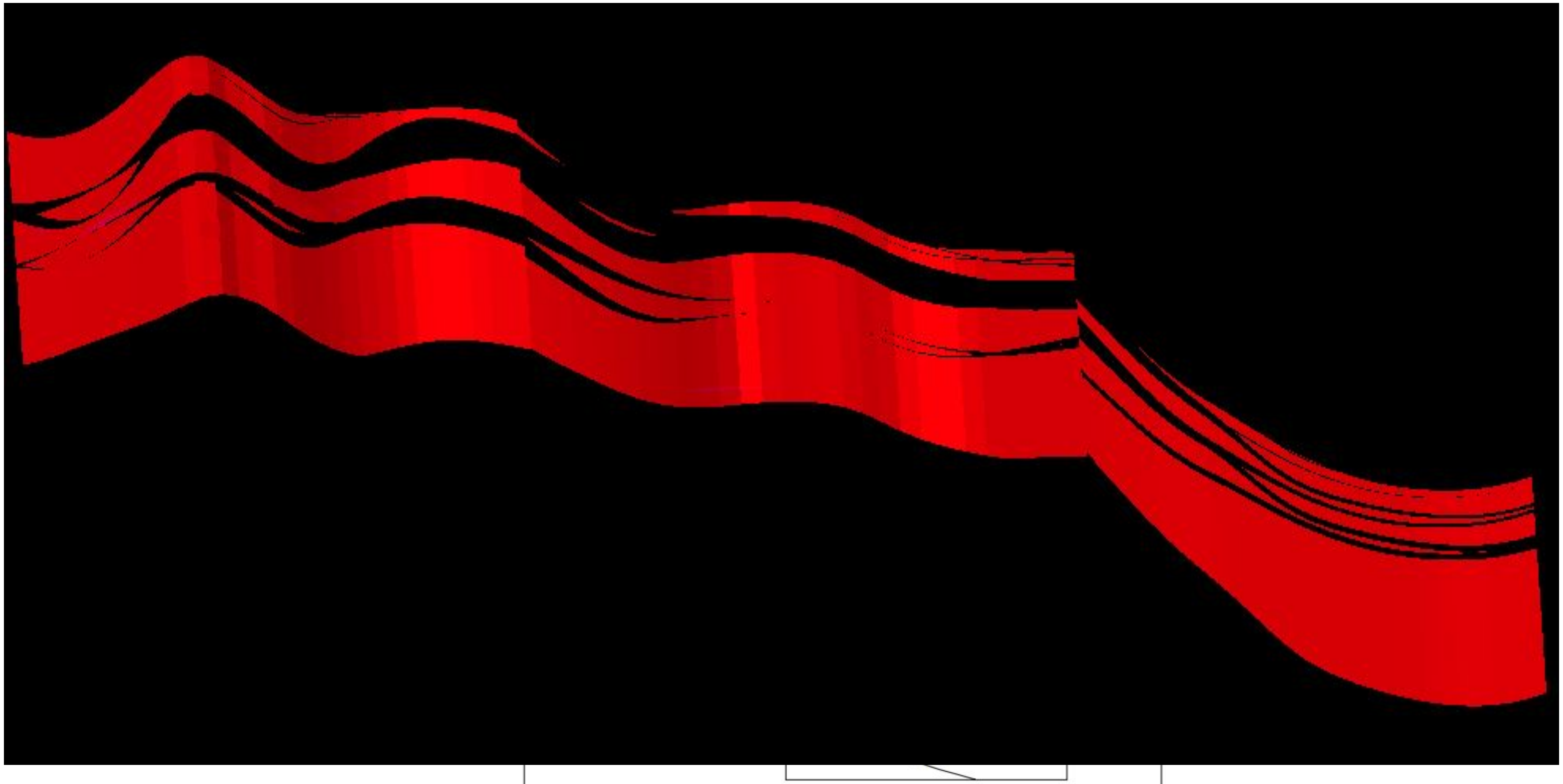
Selected area tectonic map (after Kontorovich, 200[illegible])

3. Geomodelling and transmissibility assessment

Formation	Porosity (frac)	Permeability(mD)	Oil Saturation(per)
U_1^1A+B	0.16	11	64.9
U_1^2	0.14	8.8	44
U_1^3	0.14	4.7	50.2

U_1^3 fm with full set of faults

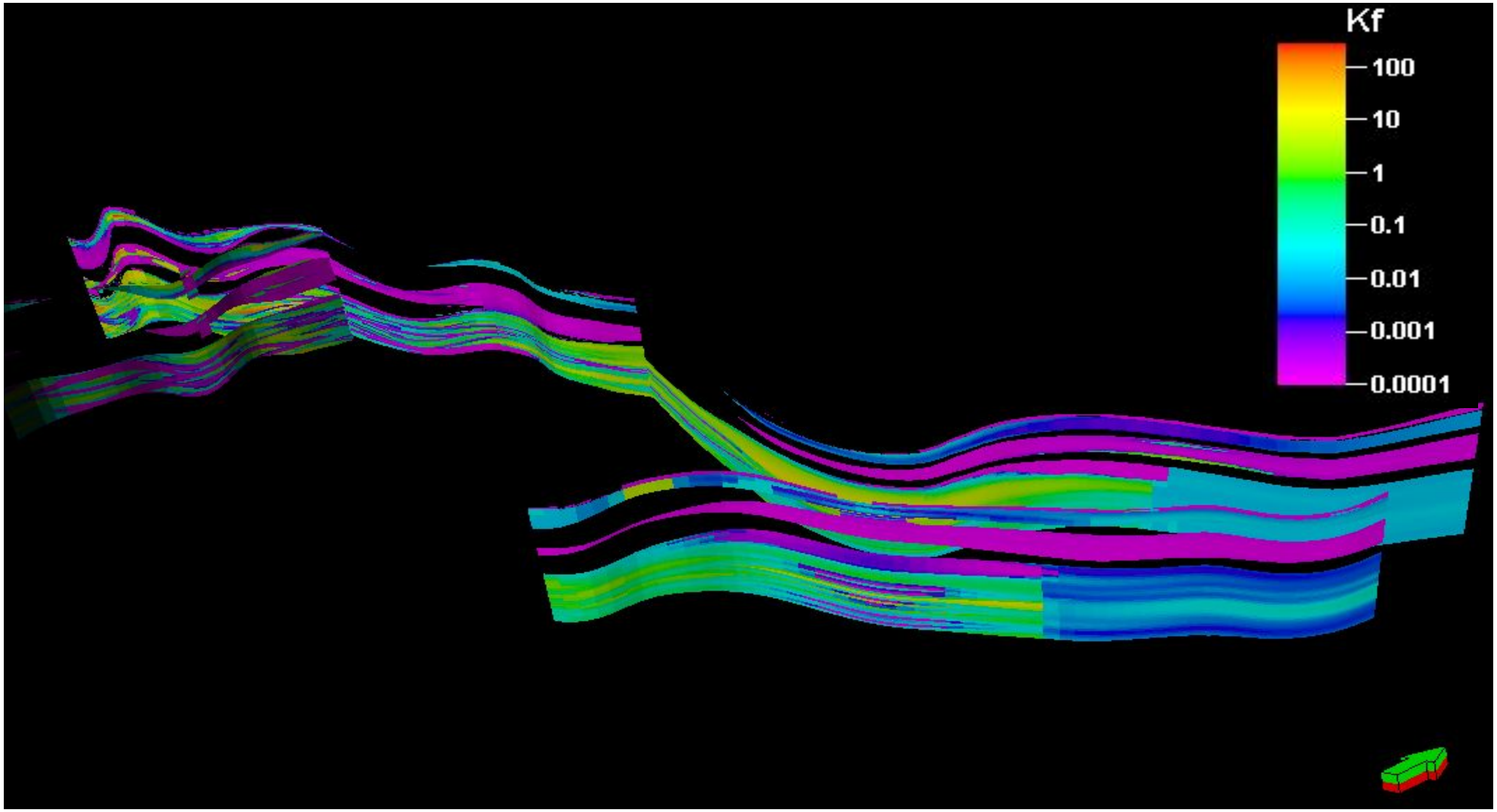
3. Geomodelling and transmissibility assessment



Fault 9 juxoposition area (Allan map)

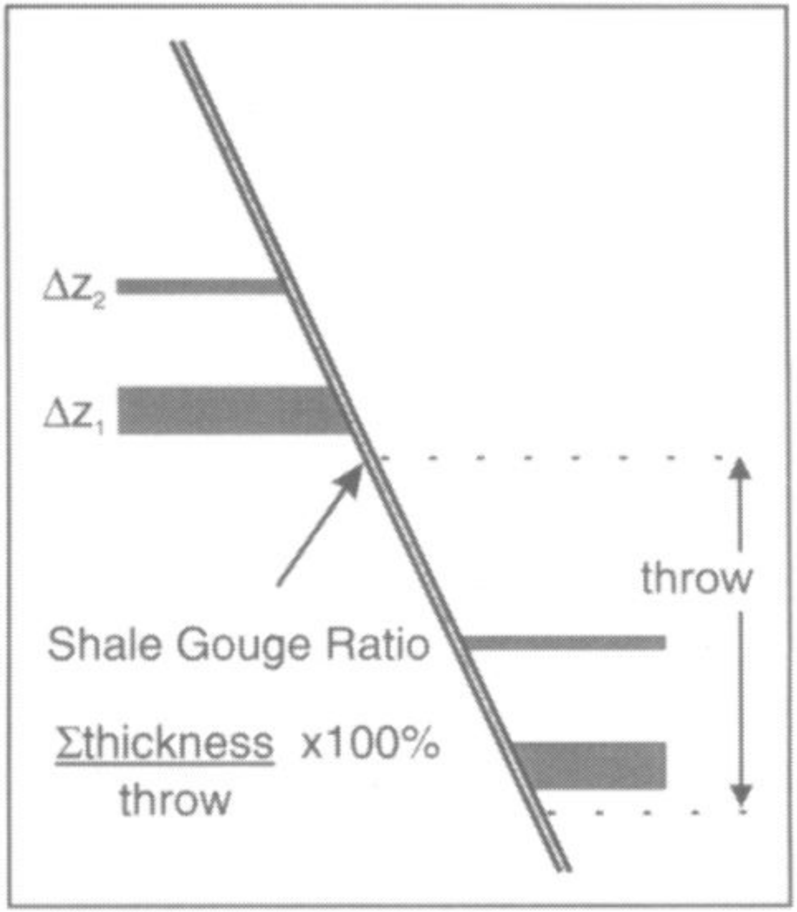
Allan diagram (HWU ResConcepts Manual)

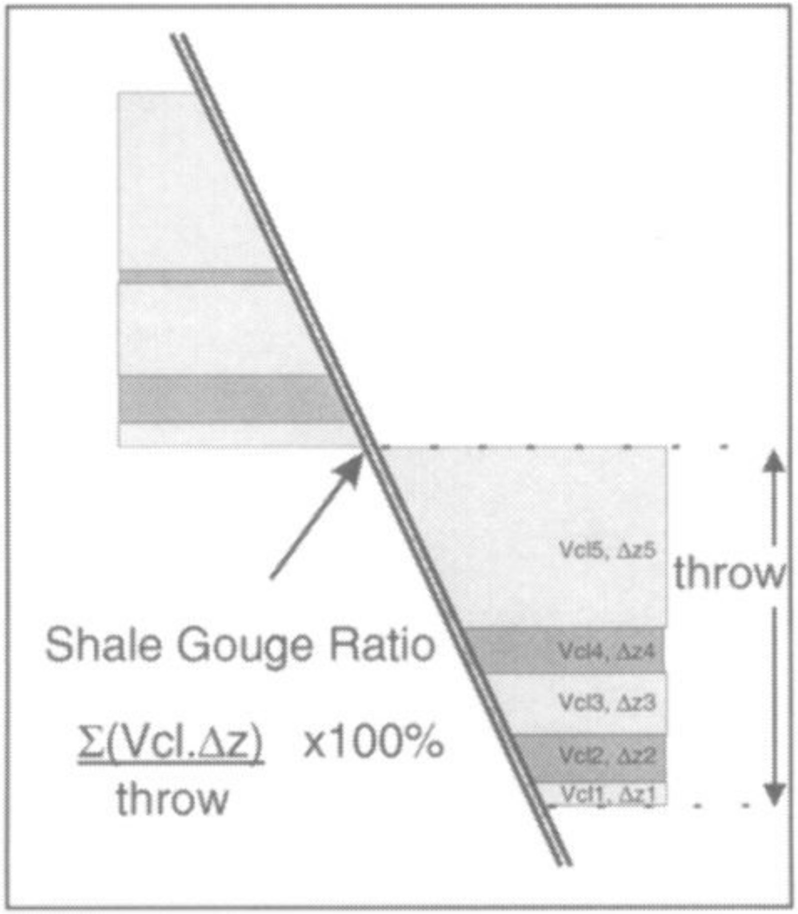
3. Geomodelling and transmissibility assessment



Results of SGR technique application

3. Analysis permeability vs. fault throw





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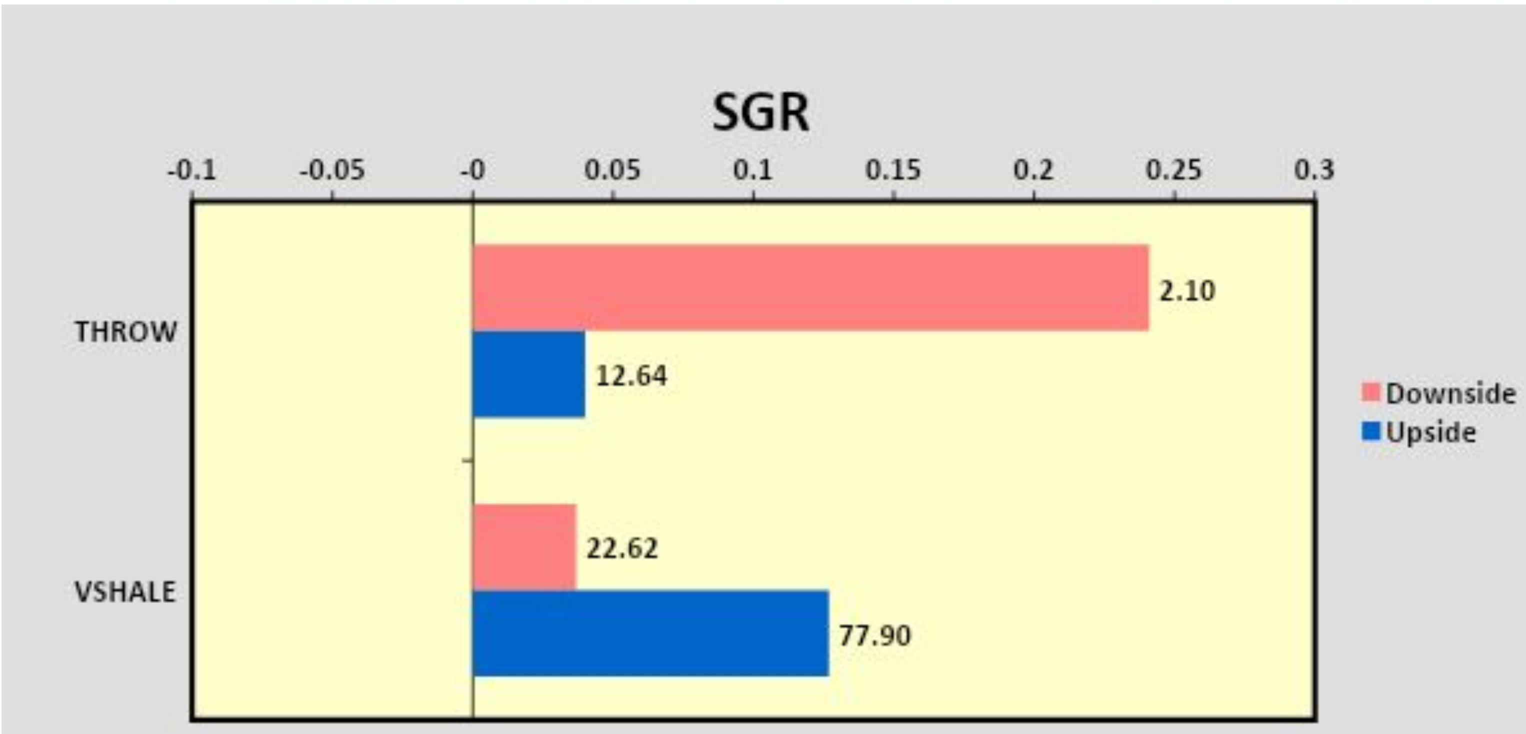
3. Analysis permeability vs. fault throw

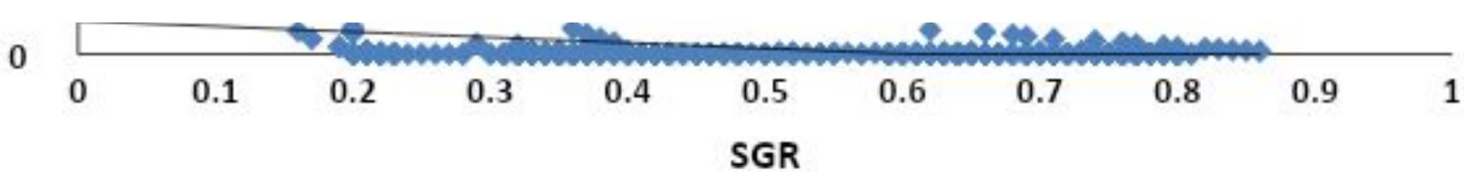


3. Analysis permeability vs. fault throw

Keff vs. SGR

Brief summary for K field

- Nonsealing fault with throw below 6.14 m;
- Fault is semipermeable (with great permeability variation) if throw varies from 2.1 m to 6.14 m;
- Fault is highly permeable, if throw less than 2.1 m.



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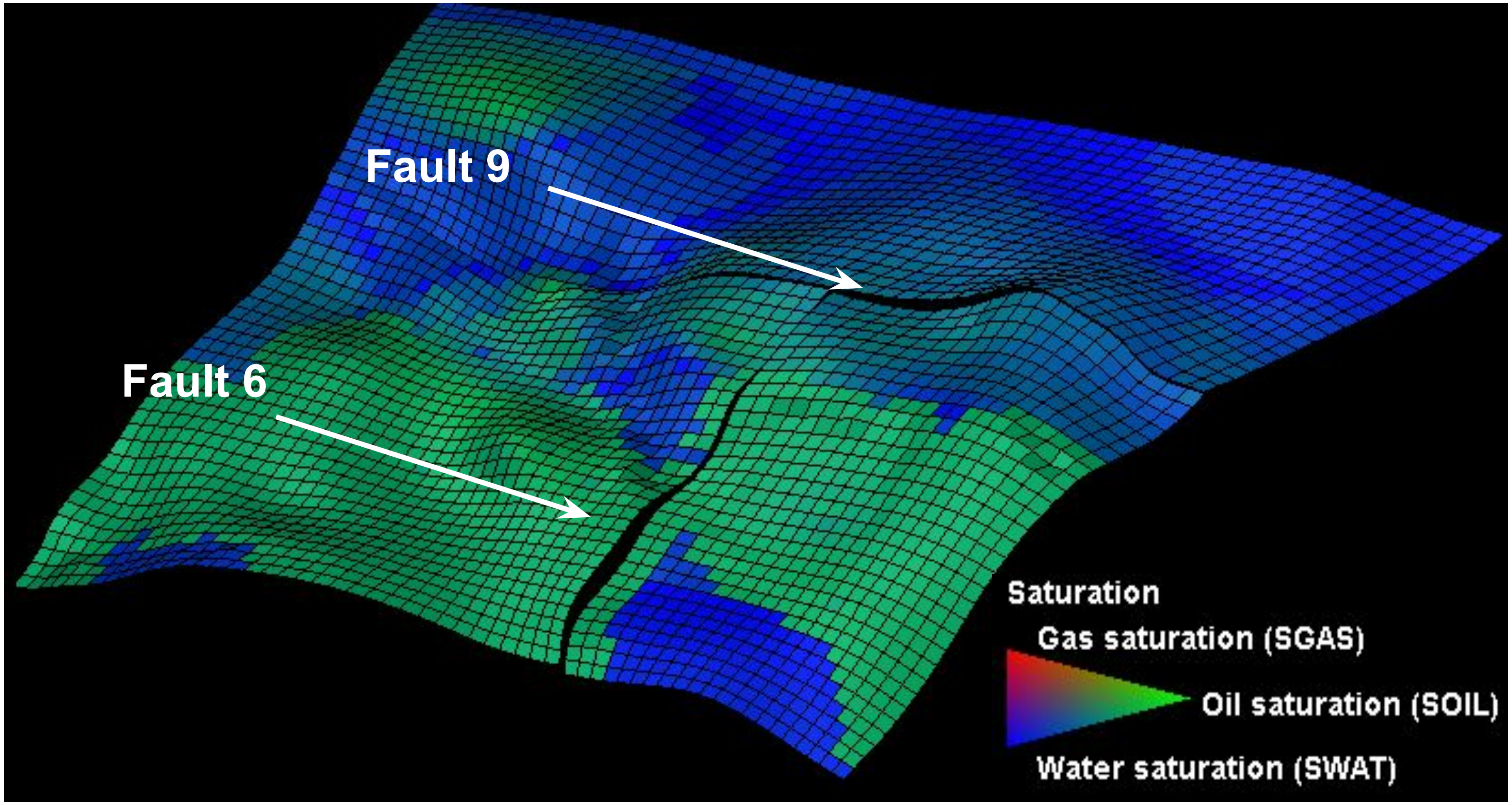
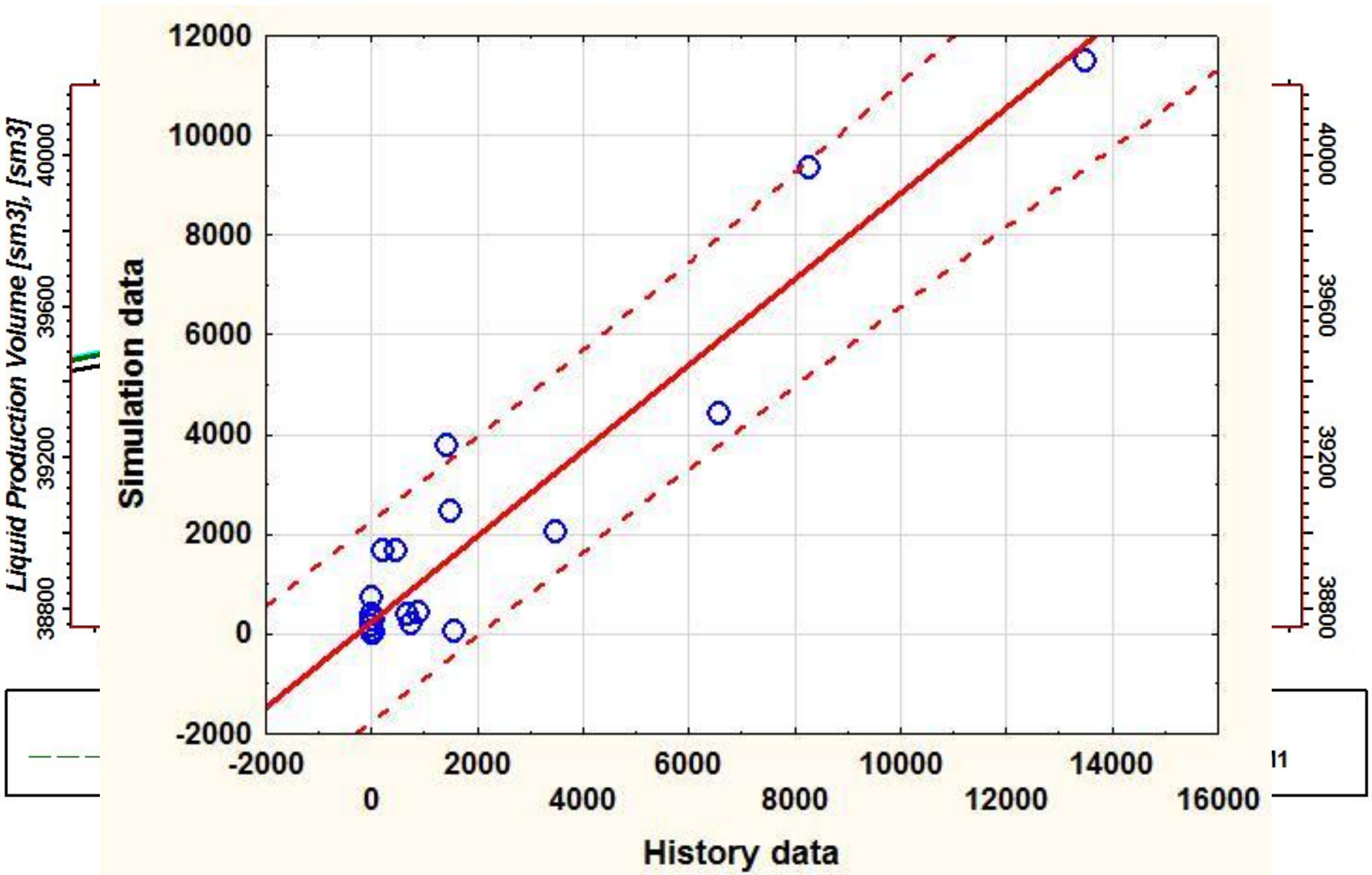
4. Choosing the best technique

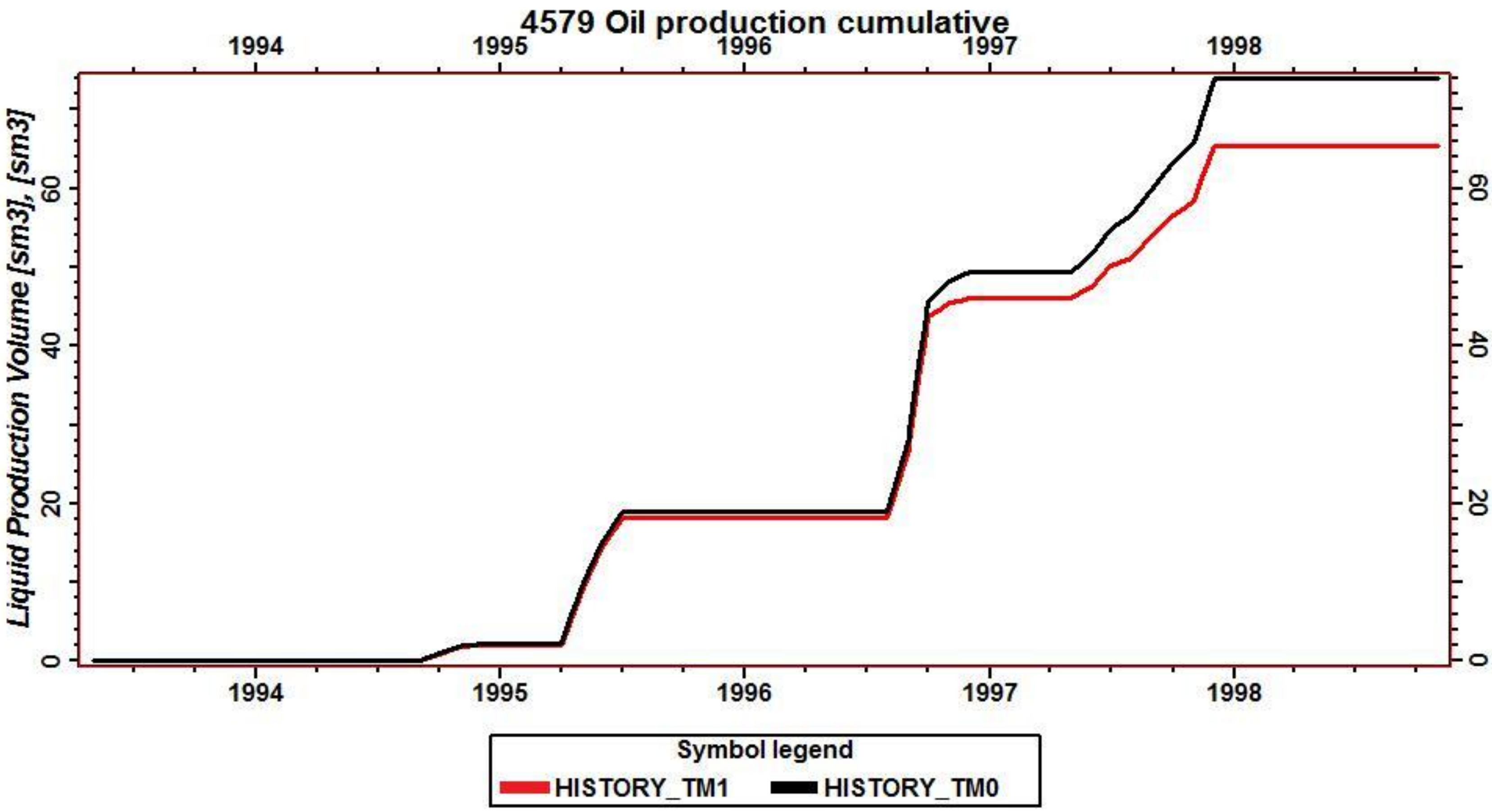


Part of simulation model U_1^2

4. Choosing the best technique



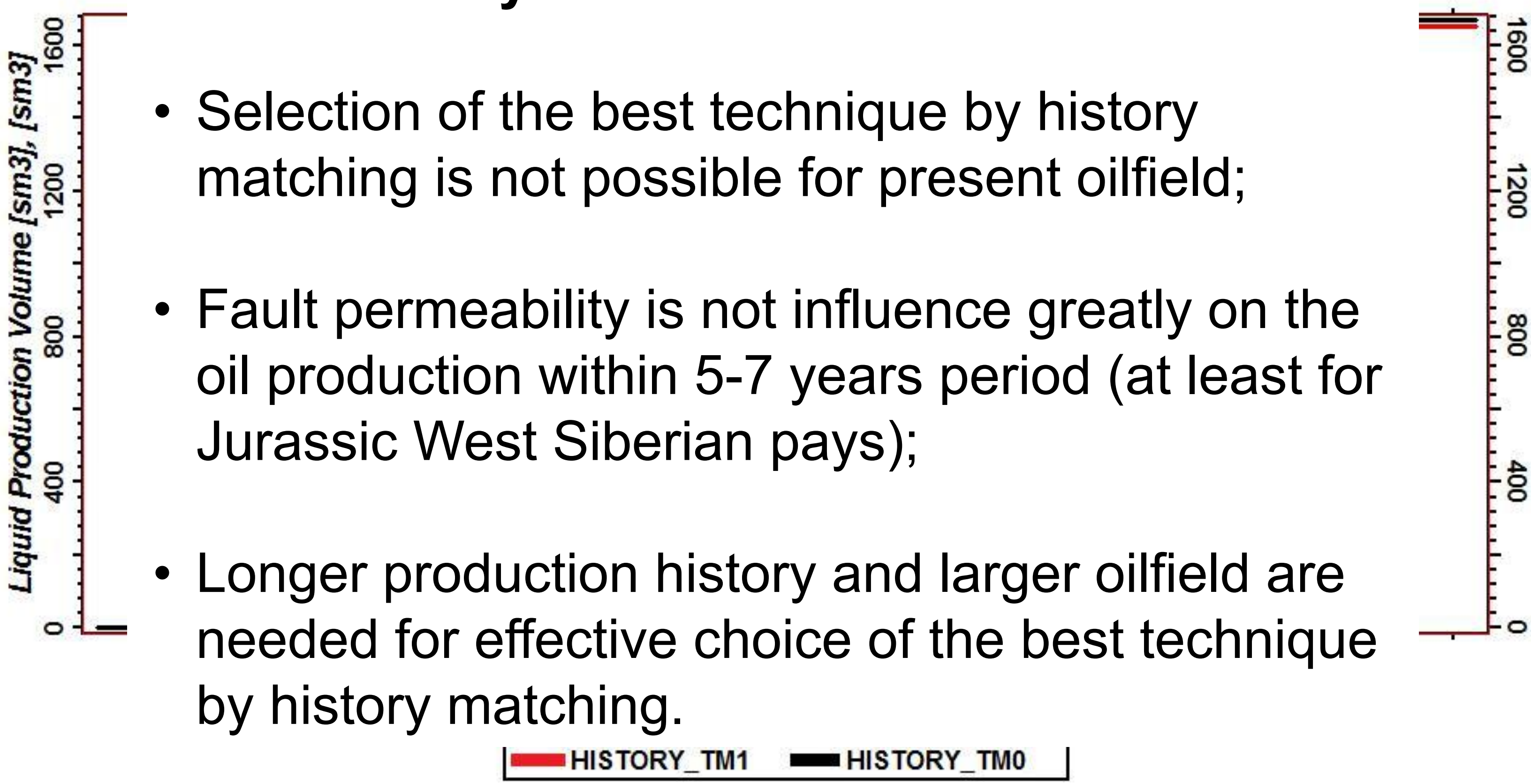
4. Choosing the best technique



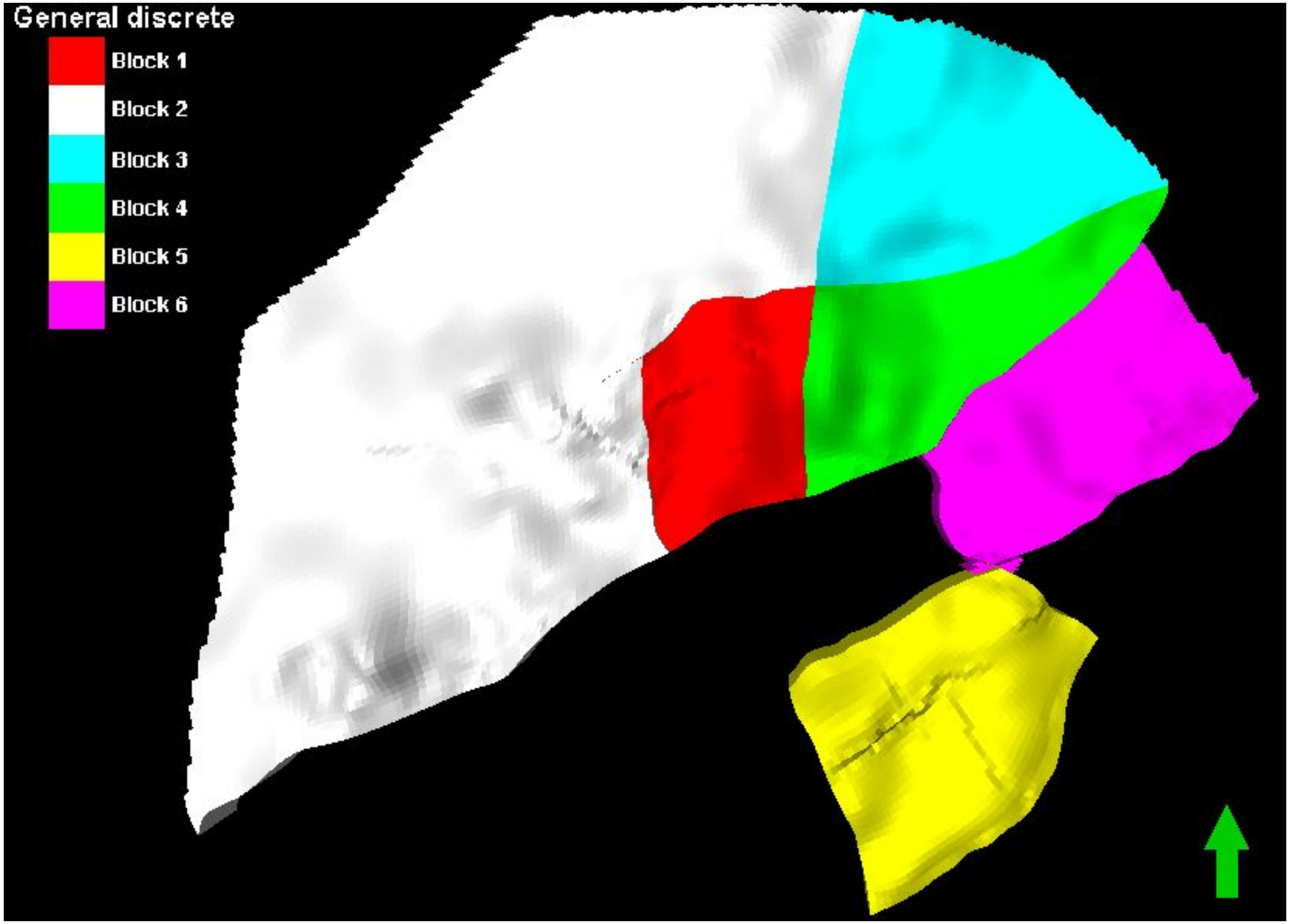
4. Choosing the best technique

Brief summary:

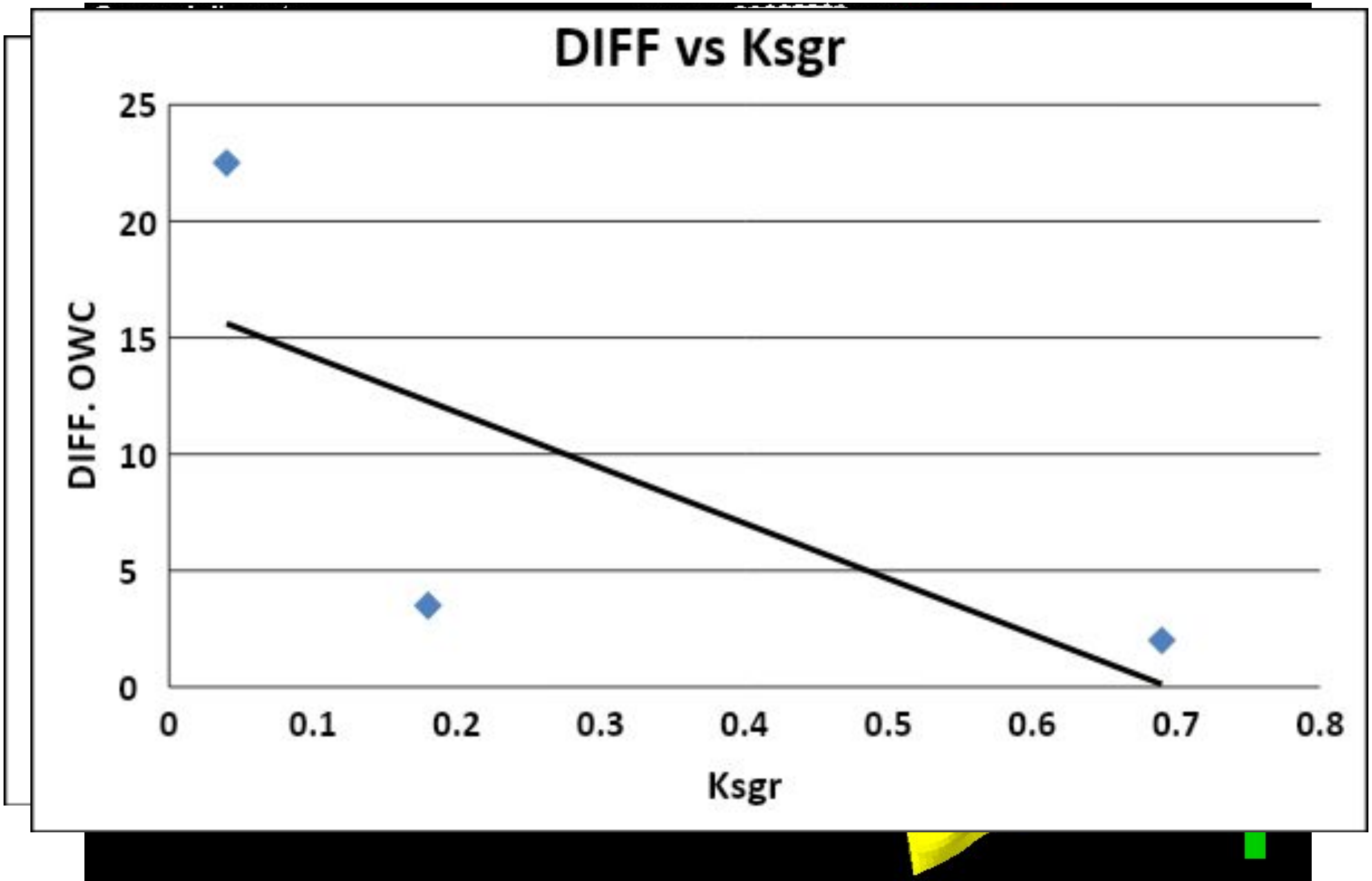
- Selection of the best technique by history matching is not possible for present oilfield;
- Fault permeability is not influence greatly on the oil production within 5-7 years period (at least for Jurassic West Siberian pays);
- Longer production history and larger oilfield are needed for effective choice of the best technique by history matching.



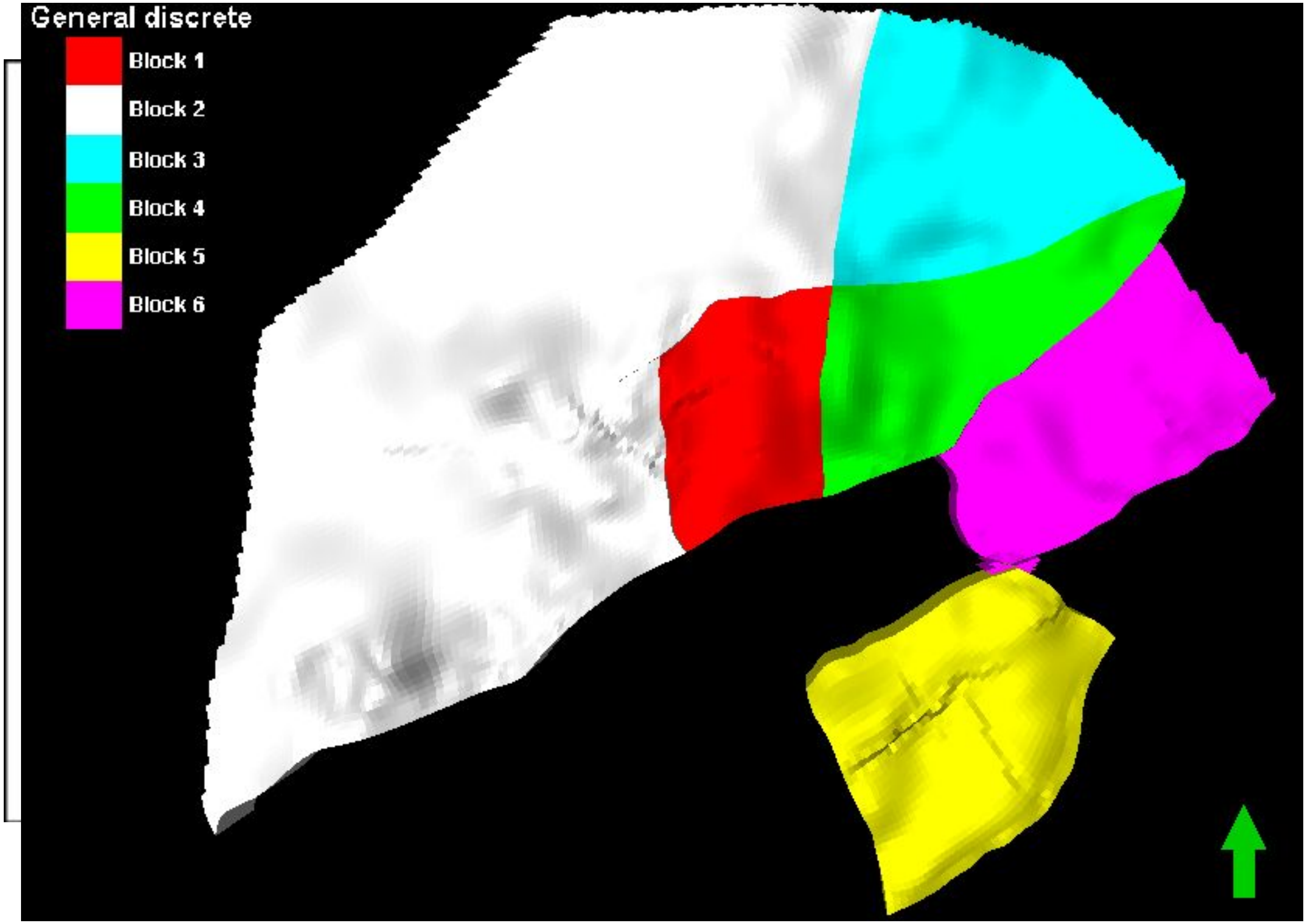
4. Choosing the best technique



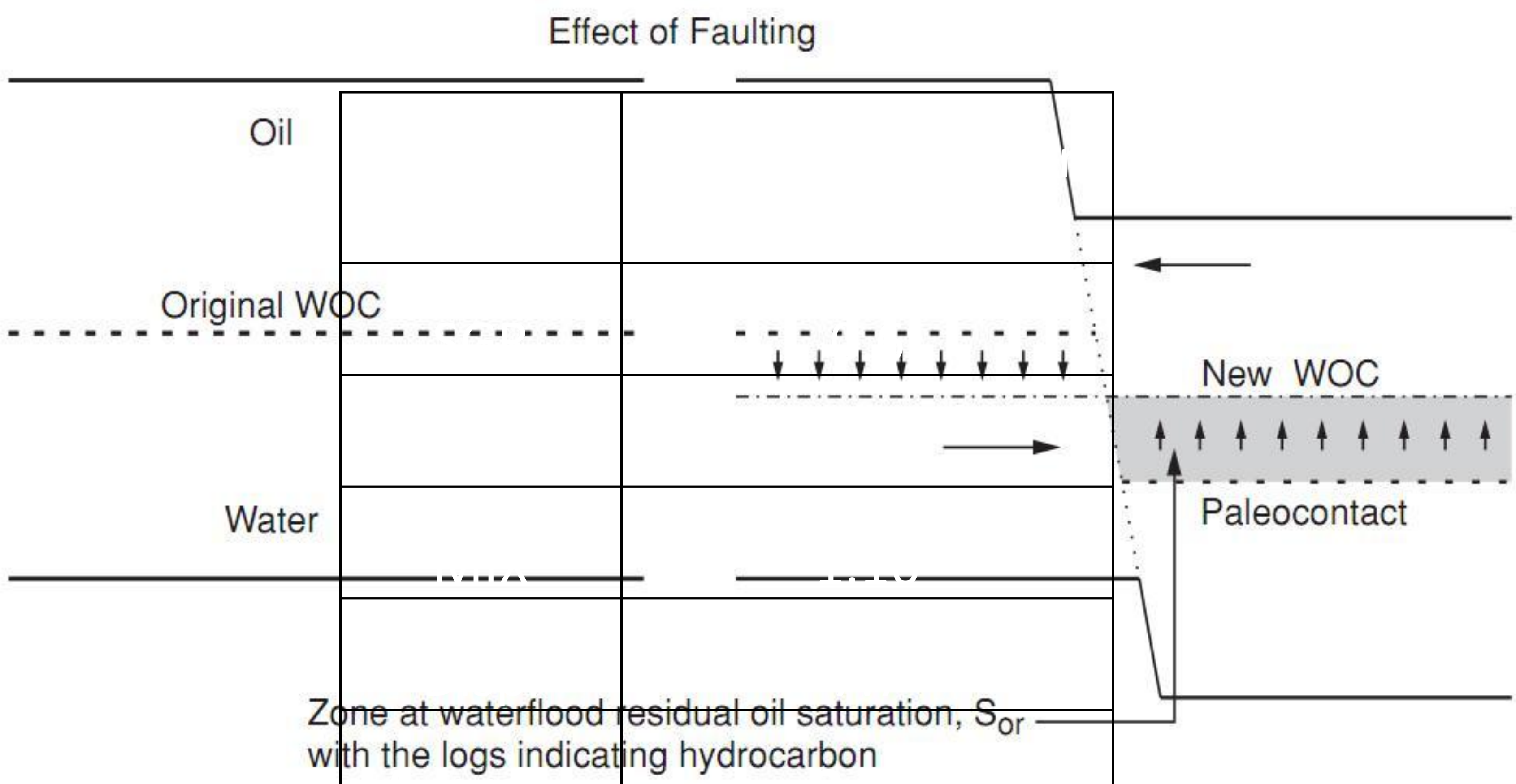
4. Choosing the best technique



4. Choosing the best technique

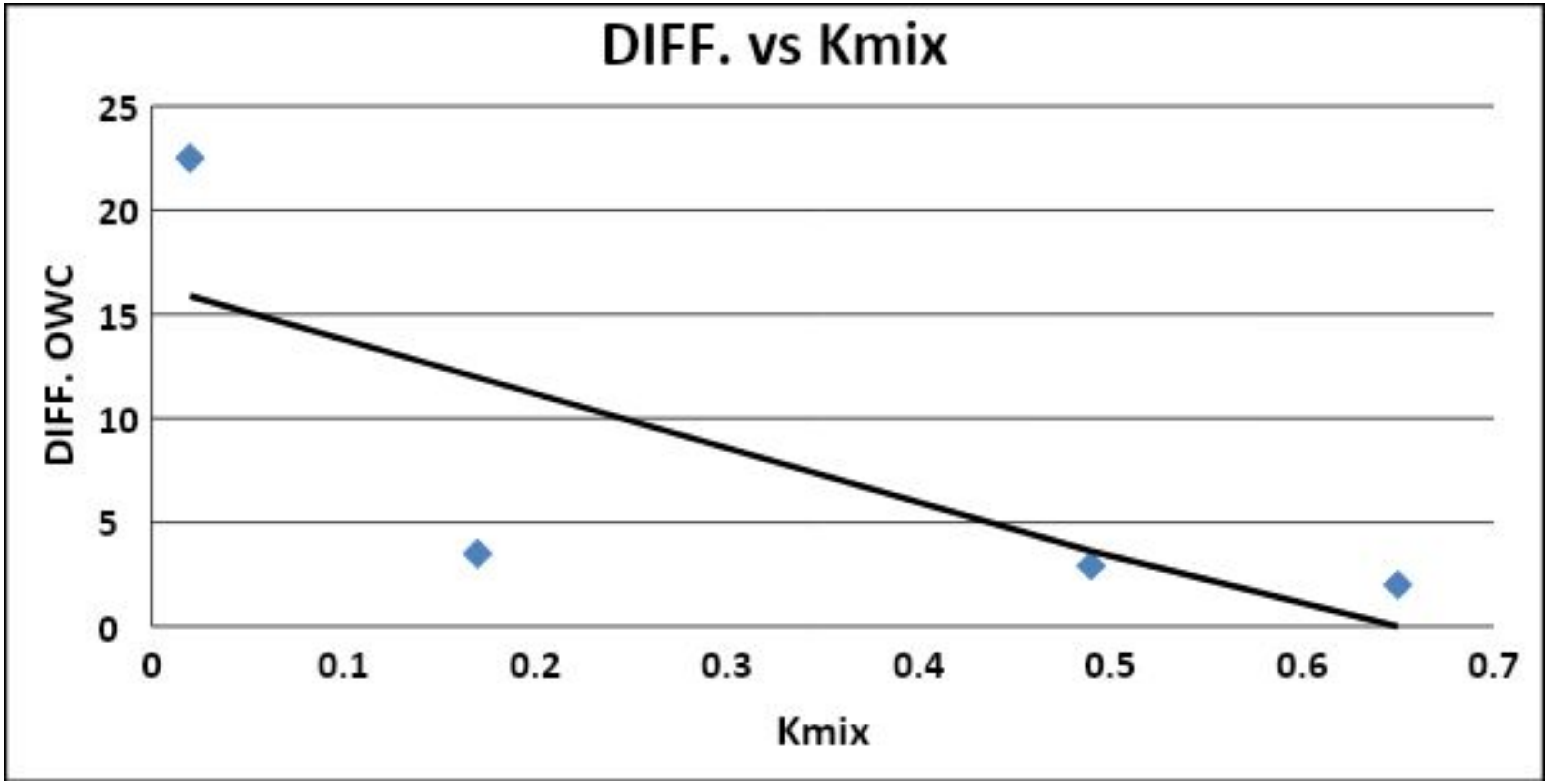


4. Choosing the best technique



Well test manual. HWU

4. Choosing the best technique



Practical summary

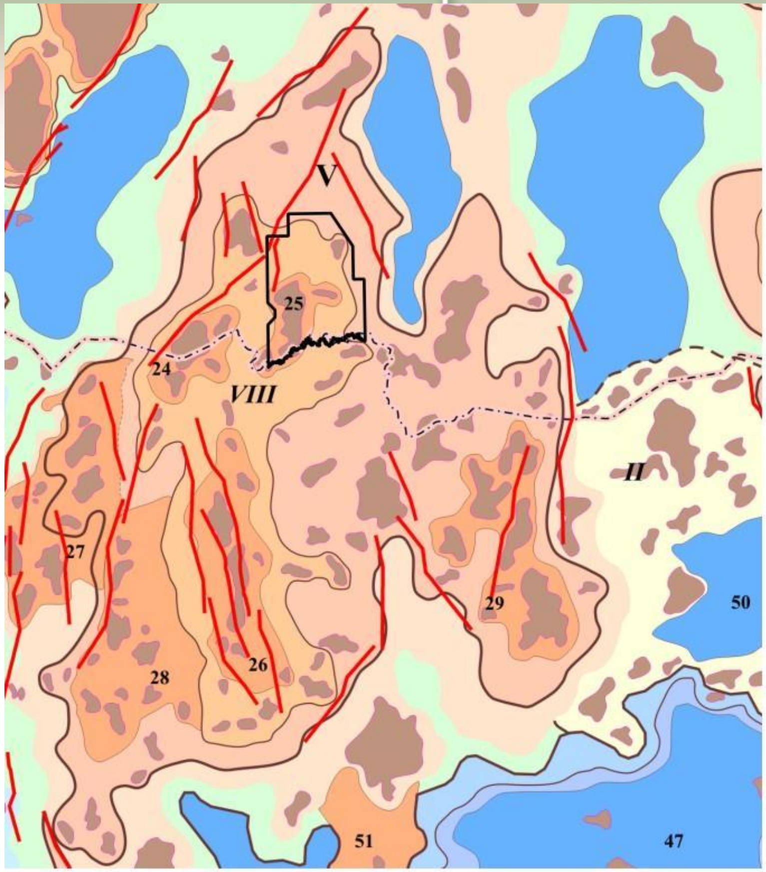
- Fault transmissibility along the fault plane is not unique value and may be effectively modelled in geomodel scale;
- No sealing fault with throw less than 6.14 m;
- Fault permeability varies greatly if throw is between 2.1 and 6.14 m;
- Fault is fully permeable if throw is less than 2.1m;
- Fault permeability does not influence greatly on the production during 5-7 years period or equivalent 40000tonn (at least for West Siberian Jurassic oilfields);
- The best technique of transmissibility assessment for oilfield K is integration of SGR & CSF.

Thank you for you attention!

Backslides

Suggestion for further work

- Wider range of the oilfields should be investigated to choose main criteria and universal dependences for transmissibility for West Siberia;
- High quality 3D seismic is needed for high accuracy of transmissibility determination;
- Cretaceous pays should be investigated for crossflow;
- Special attention should be paid on pre-Mesozoic oilfield;
- Additional investigations as repeat formation tester, good quality well test and tracer tests are needed;
- Transmissibility assessment is needed to be checked by history matching process, but this method may be created only on large oilfield with long period of production.



The First generation structure
V- Aleksandrov dome

The Second generation structure
II- Karamin mezoanticline
VIII- Traigorod mesodome

Boundary of the oilfield K

The Third generation structure
24- Ohteur elevation
25- Vach elevation
26- Krivolut arch
27- West-Aleksandrov arch
28- Poluden knoll
29- Okun arch
47- Negot downwarding
50- Sangil downwarding
51- Mural knoll

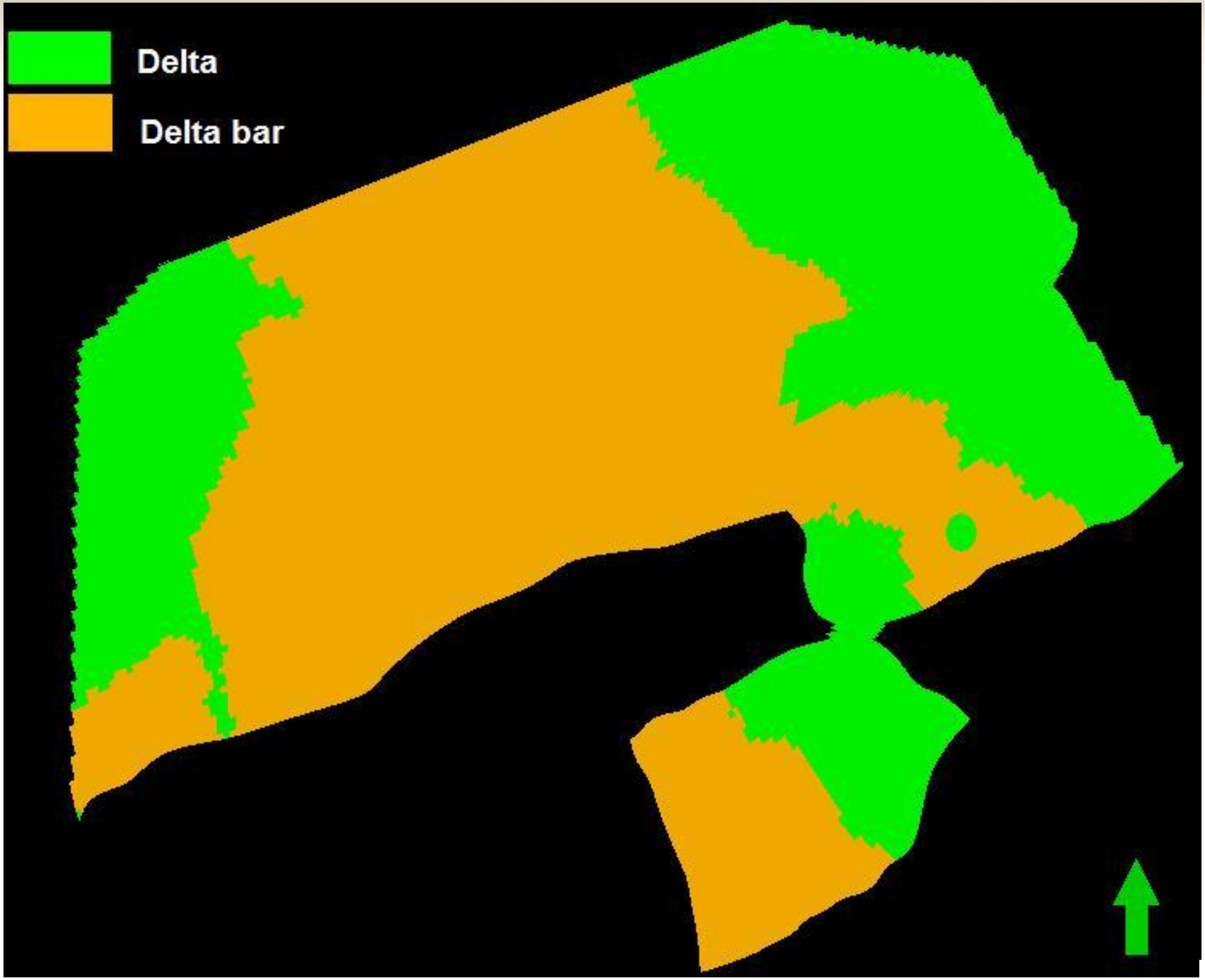
Faults

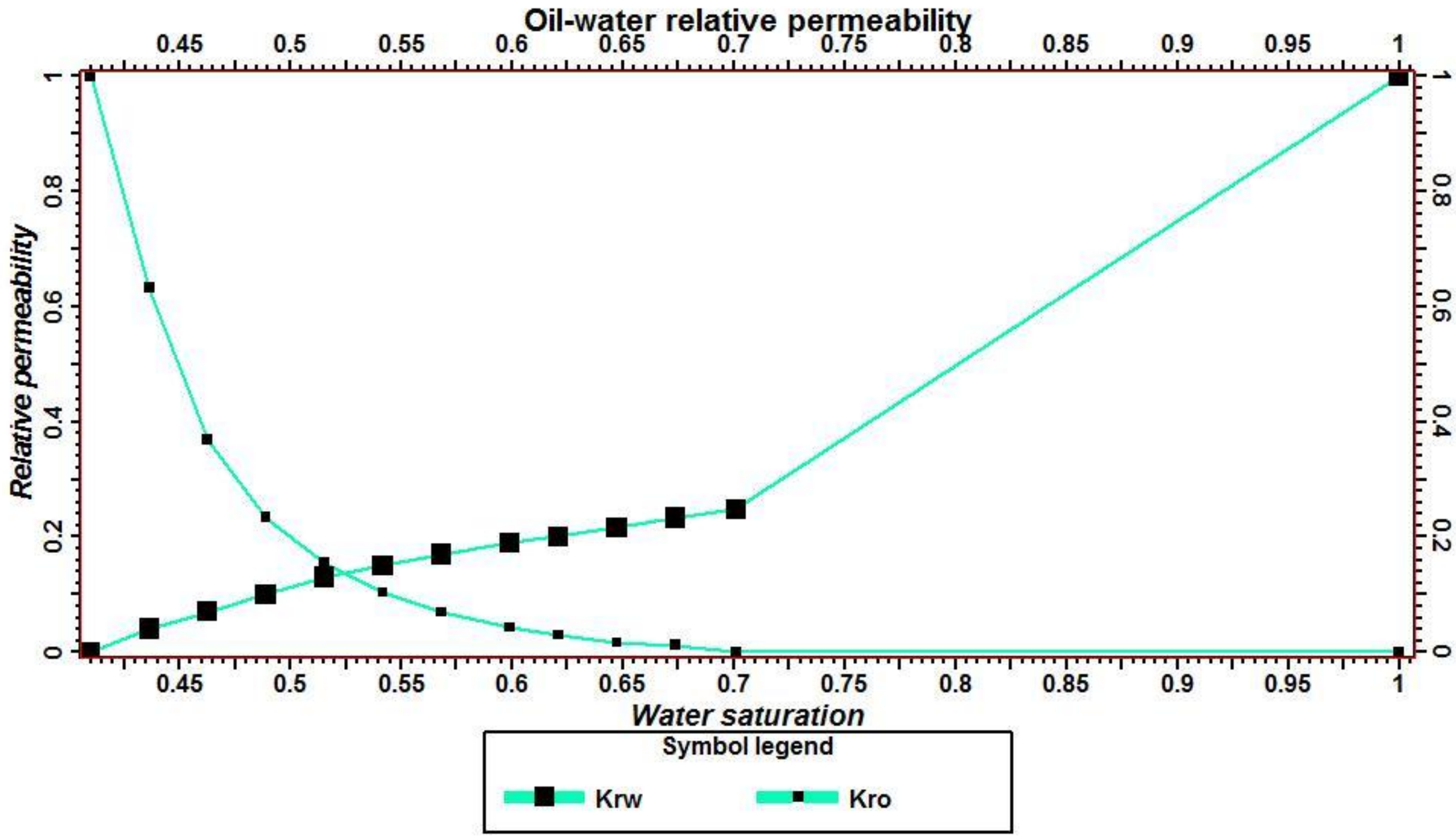
Oilfields

Fragment of West Siberian tectonic map. Kontorovich 2003

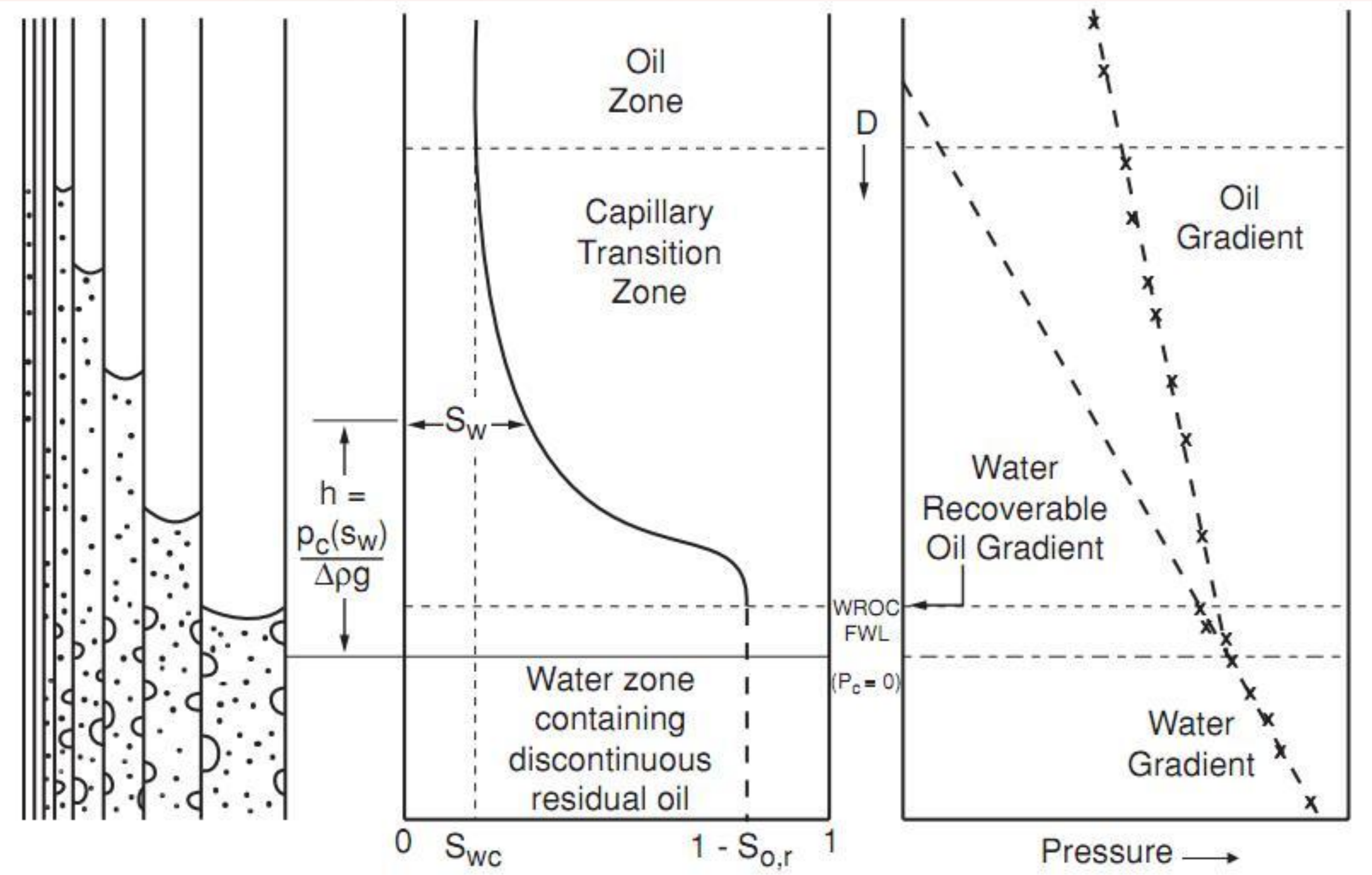
Faults	Maximum throw (m)

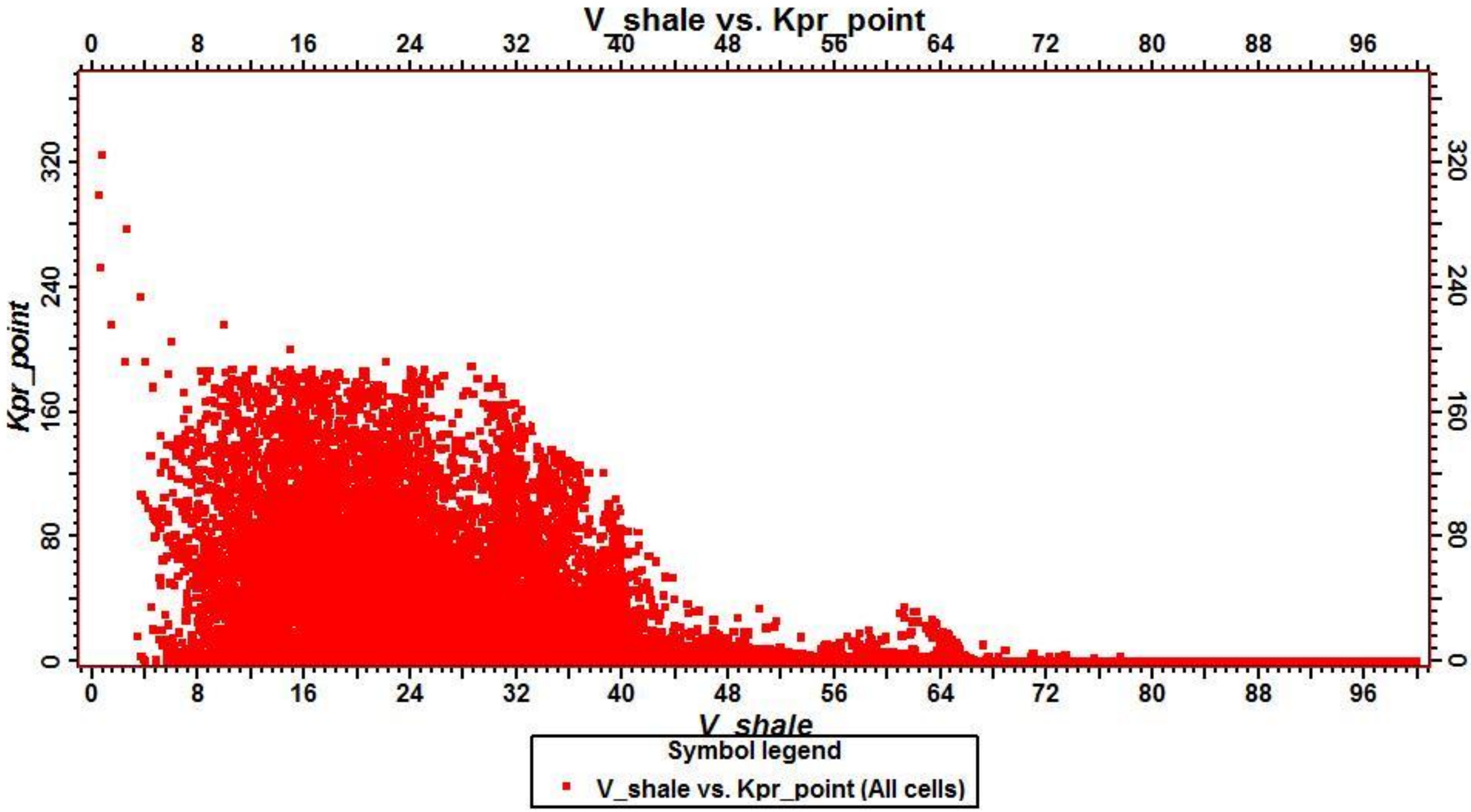
Maximum throw of each fault

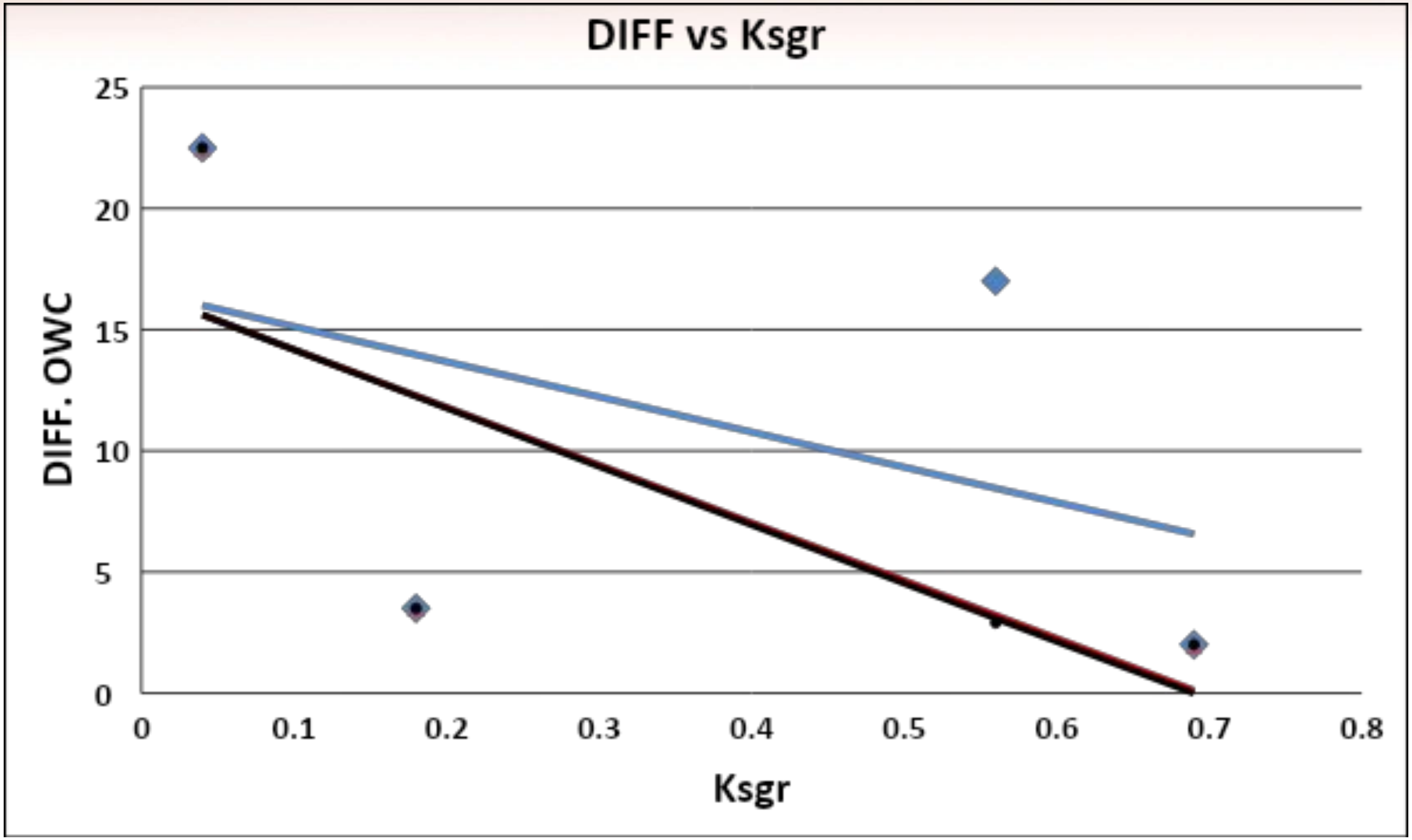

Delta
Delta bar

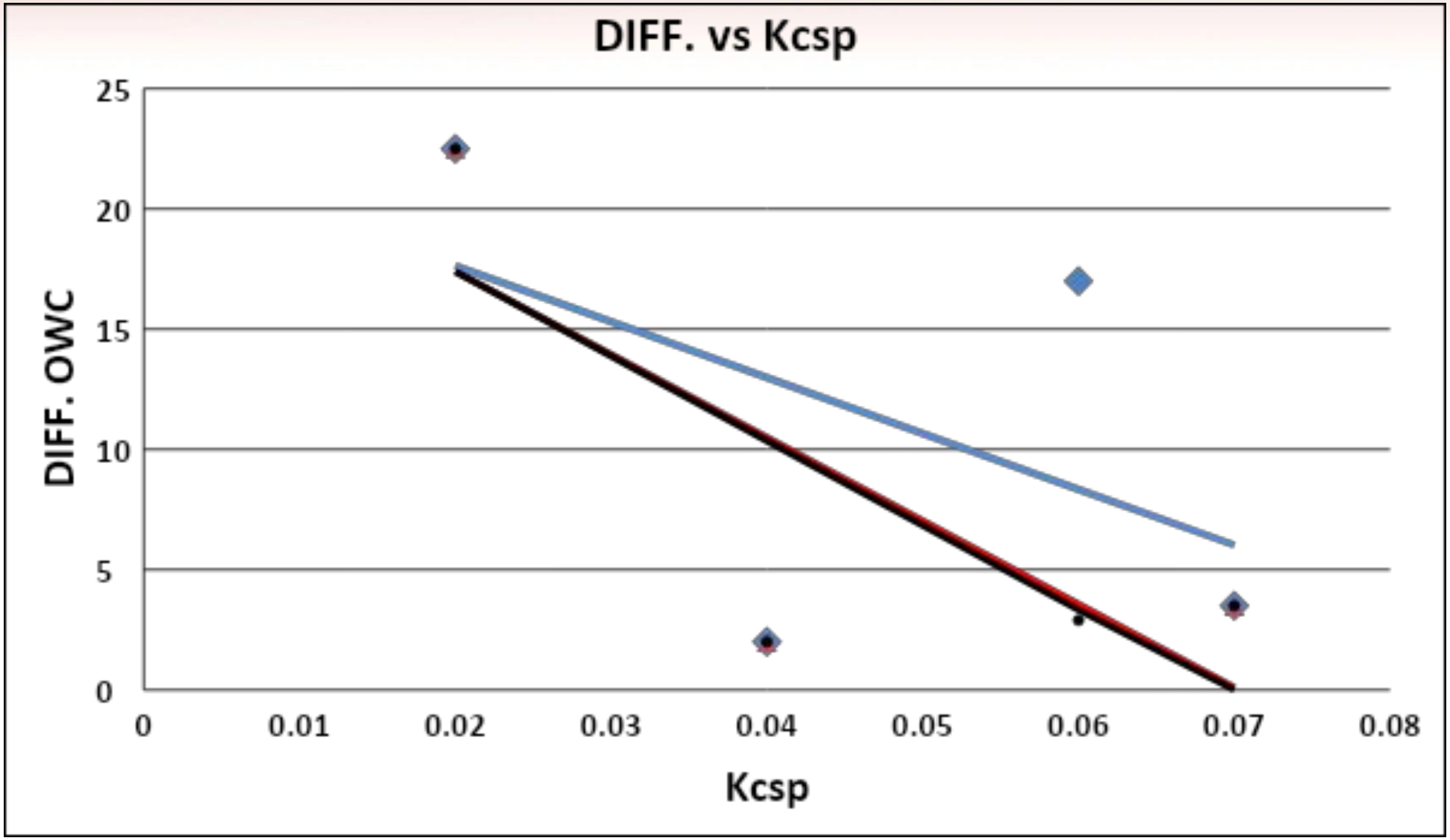


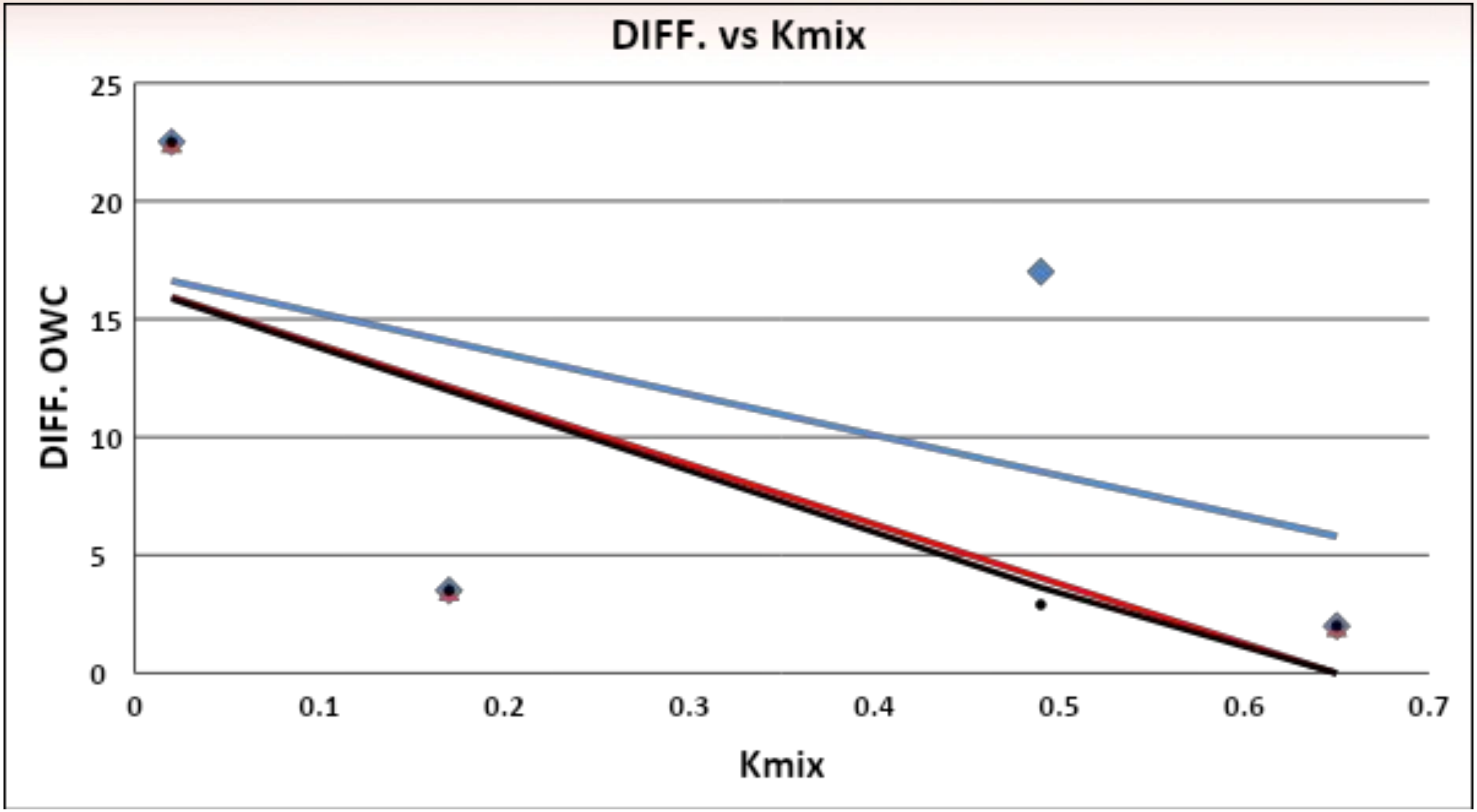
Relative permeabilities for U_1^{2+3}


Oil
Zone
Capillary
Transition
Zone
D
Oil
Gradient
S_w
h =
$\frac{p_c(s_w)}{\Delta\rho g}$
Water
Recoverable
Oil Gradient
WROC
FWL
($P_c = 0$)
Water zone
containing
discontinuous
residual oil
Water
Gradient
0
S_{wc}
$1 - S_{o,r}$
1
Pressure


V_shale vs. Kpr_point
0
8
16
24
32
40
48
56
64
72
80
88
96
Kpr_point
320
240
160
80
0
V_shale
Symbol legend
V_shale vs. Kpr_point (All cells)


DIFF vs Ksgr
DIFF. OWC
Ksgr
0
5
10
15
20
25
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8


DIFF. vs Kcsp
25
20
15
10
5
0
DIFF. OWC
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Kcsp


DIFF. vs Kmix
DIFF. OWC
Kmix
0
5
10
15
20
25
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7