



Nova Scotia  
OFFSHORE

# TRAP SIZE DISTRIBUTIONS (4-WAY DIP CLOSURES ONLY)

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# NOVA SCOTIA OFFSHORE TRAP VOLUMES



The total basin resource potential for the Nova Scotia Offshore was calculated using BEICIP's 3D petroleum systems model Themis 3D. The model was constructed using output from the 3D facies model Dionisos.

Five source rock horizons were modeled using the parameters listed in the table overleaf.

Themis models the total volume of hydrocarbon expelled from these source rocks is **980Bn Boe**.

Themis calculates the volume of resource trapped in the basin by computing the volume of dip closed features for each reservoir play fairway. In the model there are five play fairways:

1. Aptian-Cenomanian
2. Hauterivian-Barremium
3. Barriasian-Hauterivian
4. Oxfordian-Tithonian
5. Early to Mid Jurassic

The in place reserves are the computed by filling the dip closed features with modeled net to gross and porosity derived from the 3D facies model. The 2D time slices from this model was used as the Gross Depositional Environment maps on which the Common Risk Segment Mapping was done. In the CRS exercise the GDE maps were hand modified to ensure they were geological reasonable. Note that these revised GDE's were not then incorporated back into Themis.

# Source Rock parameters

	Approx. Age	Initial TOC	Kerogen type and initial IH	Description
<b>APTIAN</b>	122 Ma	<b>2 %</b> (constant)	<b>III</b> (continental) IH = 235 mgHC/gTOC (Dogger. North Sea) - Open system kinetics - Vandenbrouke et al. 1999	Potential source rock in the Naskapi shale, identified in some wells. Variable effective thickness between 0 – 100 m.
<b>VALANGINIAN</b>	136 Ma	<b>1 %</b> (constant)	<b>III</b> (continental) IH = 235 mgHC/gTOC (Dogger. North Sea) - Open system kinetics - Vandenbrouke et al. 1999	Very poor and scattered source rock (coal fragments in deltaic environment, through the Mississauga formation) Variable effective thickness between 0 – 200 m.
<b>TITHONIAN</b>	148 Ma	<b>3 %</b> (constant)	<b>II-III mix</b> IH = 424 mgHC/gTOC	Best defined SR, widely proven. Variable effective thickness between 0 – 50 m.
<b>CALLOVIAN</b>	160 Ma	<b>2 %</b> (constant)	<b>II-III mix</b> IH = 424 mgHC/gTOC	Uncertain extent and richness due to the lack of data. Variable effective thickness between 0 – 20 m.
<b>PLIENSBACHIAN (L. M. Jurassic)</b>	196 Ma	<b>5 %</b> (constant)	<b>II</b> (marine) IH = 600 mgHC/gTOC (Toarcian. France) - Open system kinetics - Behar et al. 1997	Suspected, not proven. Potentially present above salt basins only. Assumed average thickness 20 m.

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The porosity was derived from the burial history and modified for the effects of overpressure.

Using this approach the volume of resource and its areal distribution in the respective zones is dependent on the following:

1. Dip closed volumes
2. Modelled reservoir distribution, net to gross and porosity.

Themis assumes that salt does not seal. Therefore no salt closed features are included in the volumetrics. We have attached a structural map in the salt diapir province. This shows a large number of the potential closures that are pierced with salt diapirs and therefore not included in the basin resource calculation. We therefore assert that the basin resource potential in any area where there are salt or fault closed features will be under estimated.

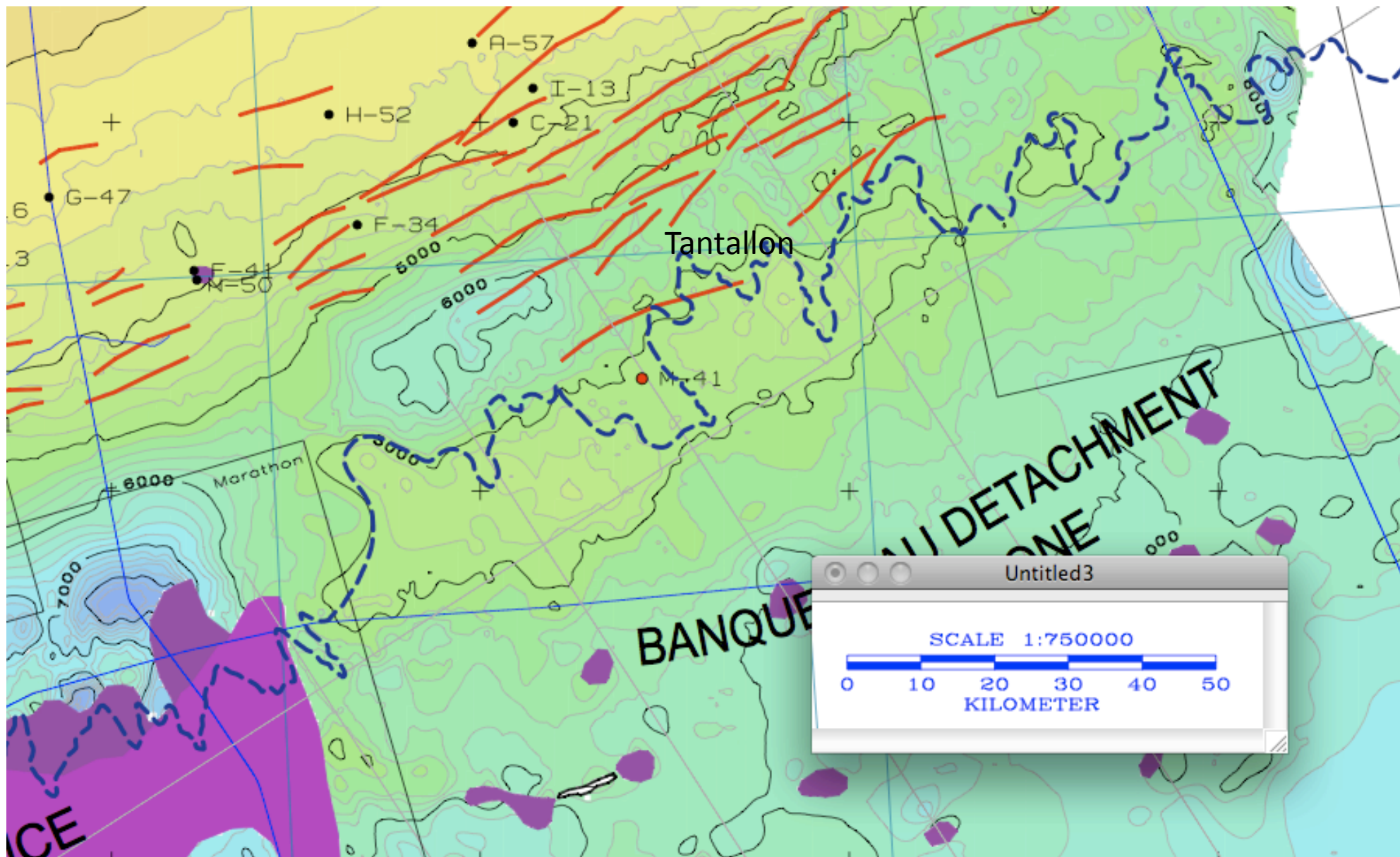
Similarly with respect to reservoir distribution, the model assumes a 'blanket reservoir' with a smooth distribution of net to gross and porosity. We know that this is not the case, particularly in the deeper water areas in which we expect more channelised and fan type reservoirs. Therefore the areal distribution of the basin resource estimates will be flawed in deep water.

Attached there are 7 figures which we suggest give a better impression of structural style and scale of dip closed features.

The first two figures are extracts from the structural map at top Hauterivian, the sealing surface for the Middle Mississauga reservoir. One figure shows a large dip closed feature in the area of the Tantallon well. We would expect this feature to be crossed by channel sands shed from the shelf edge. The second map shows the structural style in the area of the Shelbourne and Torbruk wells – an area of intense salt diapirism. Notice the number of features closed against salt. Note that the full structural map is in the PFA Alas.

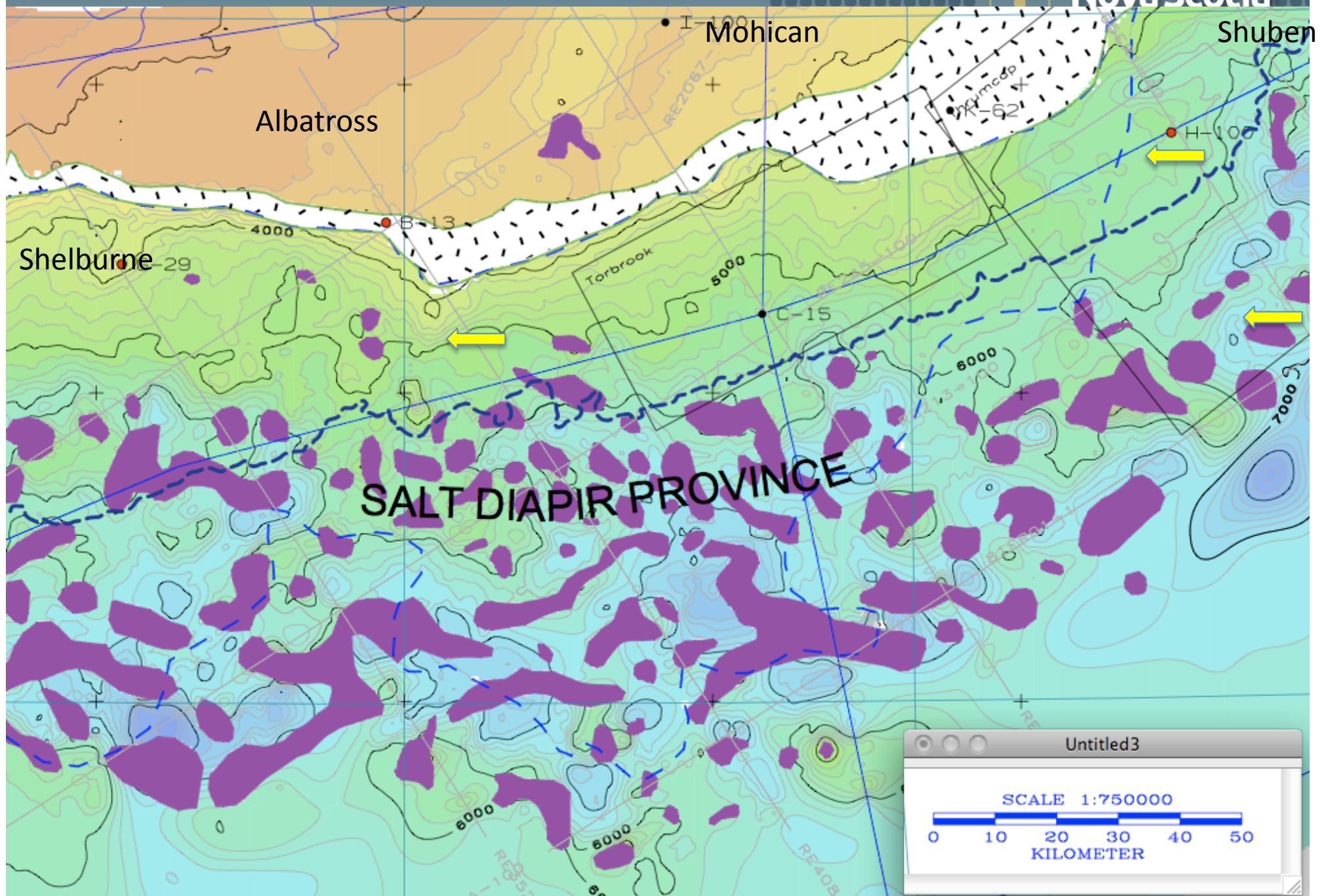
Following the two maps there are five histograms showing the Bulk Rock Volumes of all the dip closed features on each of the five reservoirs. They are self explanatory. We have also included the final basin resource histograms for comparison.

# Hauterivian MFS depth map





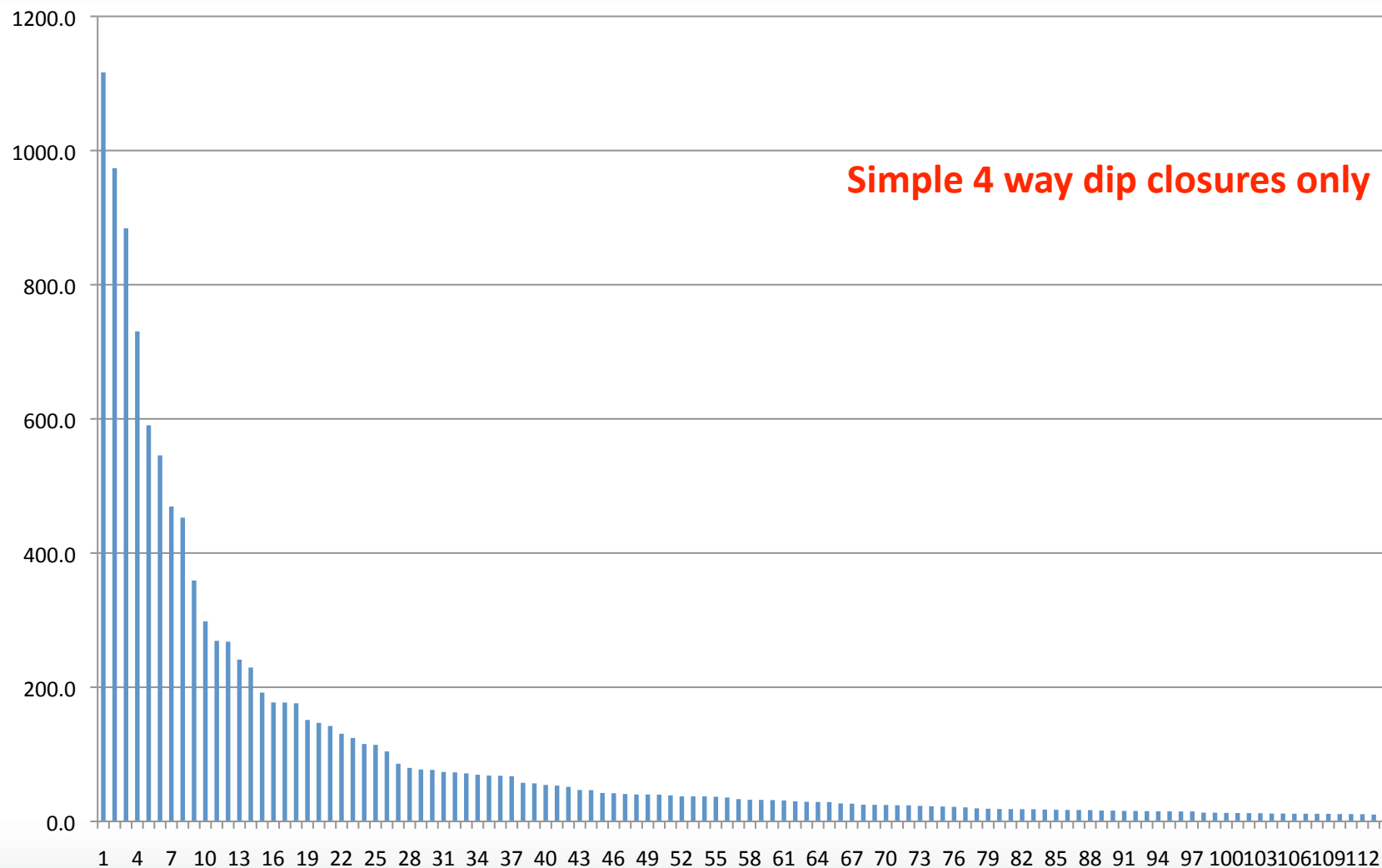
# Hauterivian MFS depth map



# Aptian-Cenomanian BRV (Mm<sup>3</sup>)



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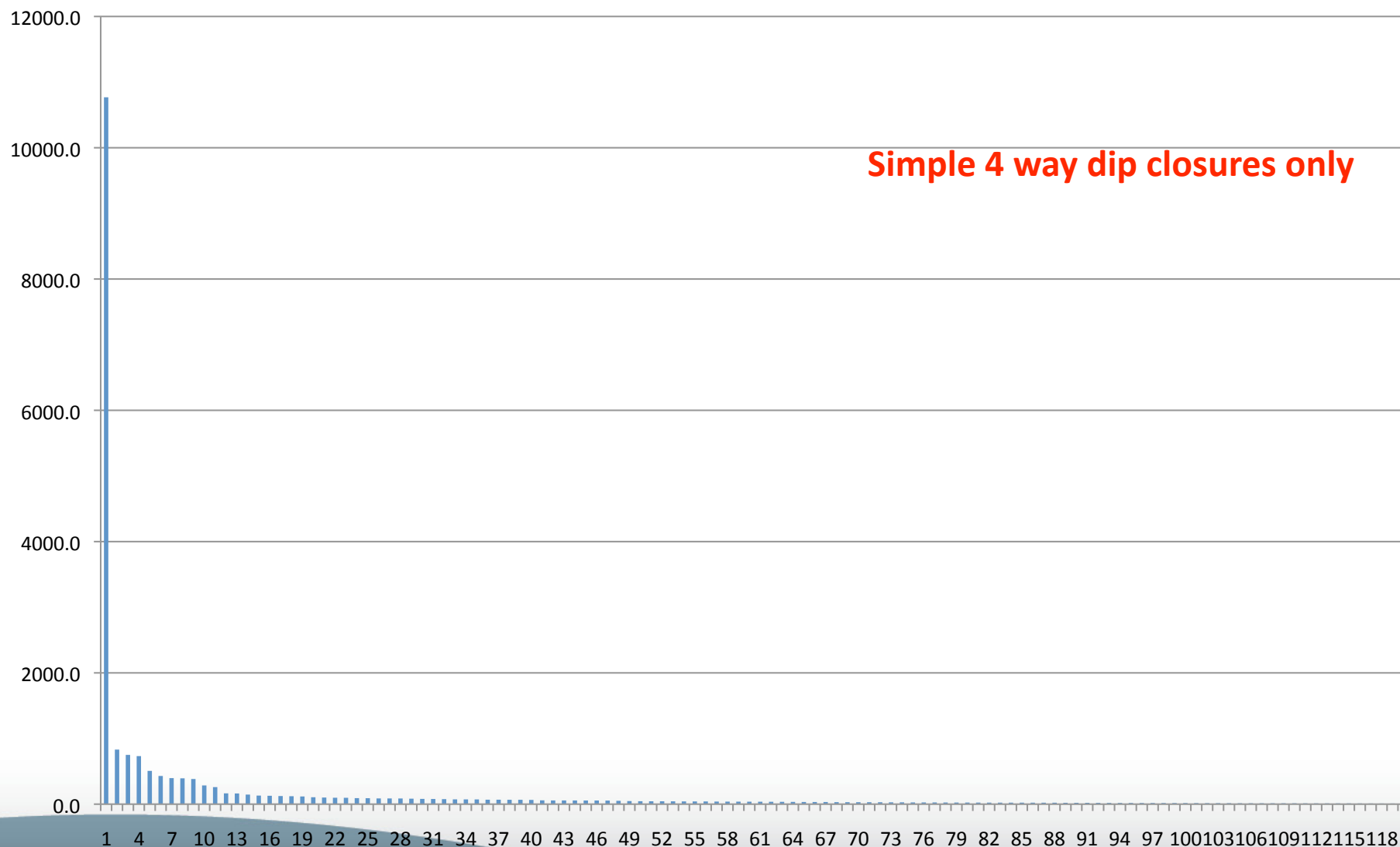


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# Hauterivian-Barremian BRV (Mm<sup>3</sup>)



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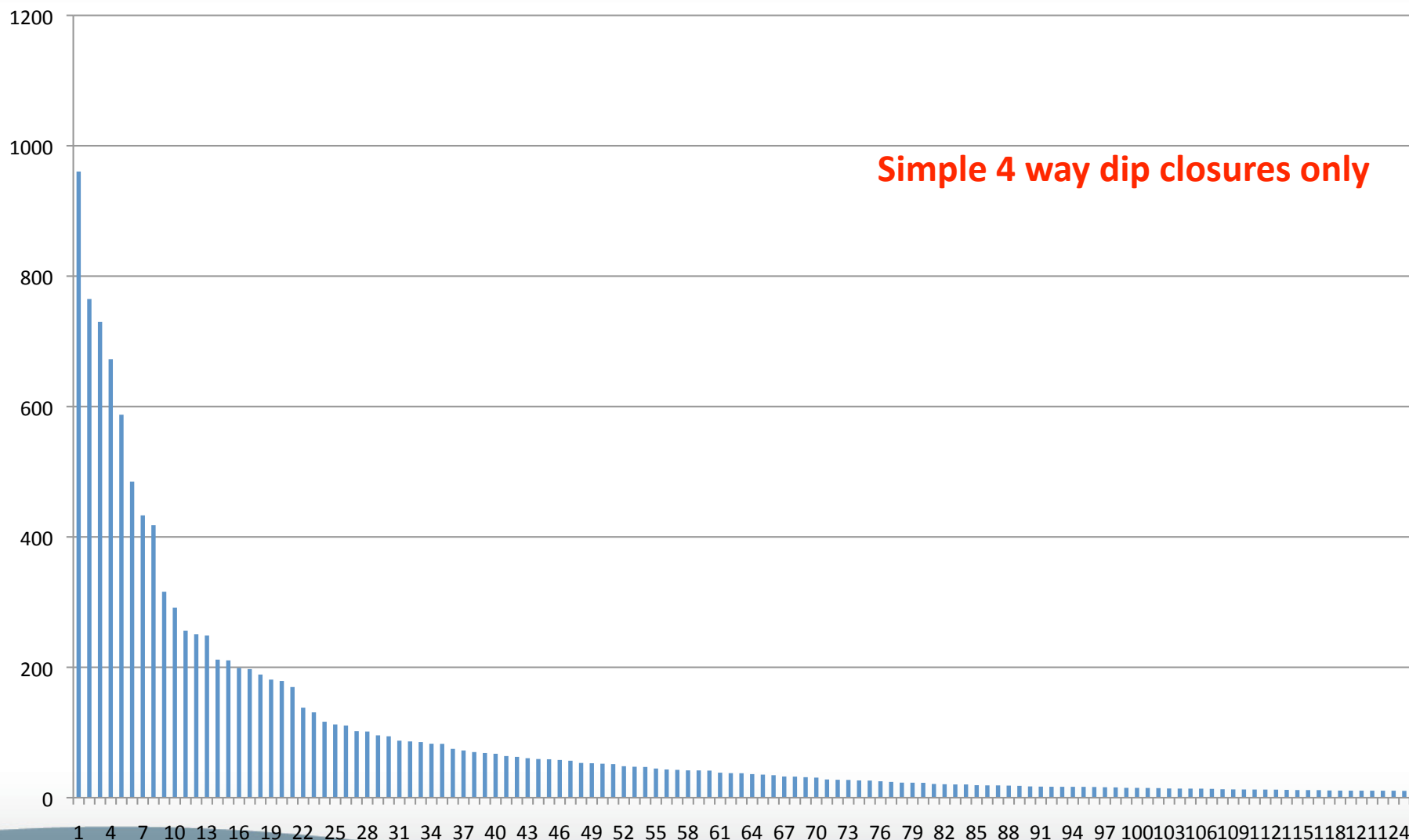


# Berriasian-Hauterivian BRV (Mm<sup>3</sup>)



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Simple 4 way dip closures only



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# Oxfordian-Tithonian BRV (Mm<sup>3</sup>)



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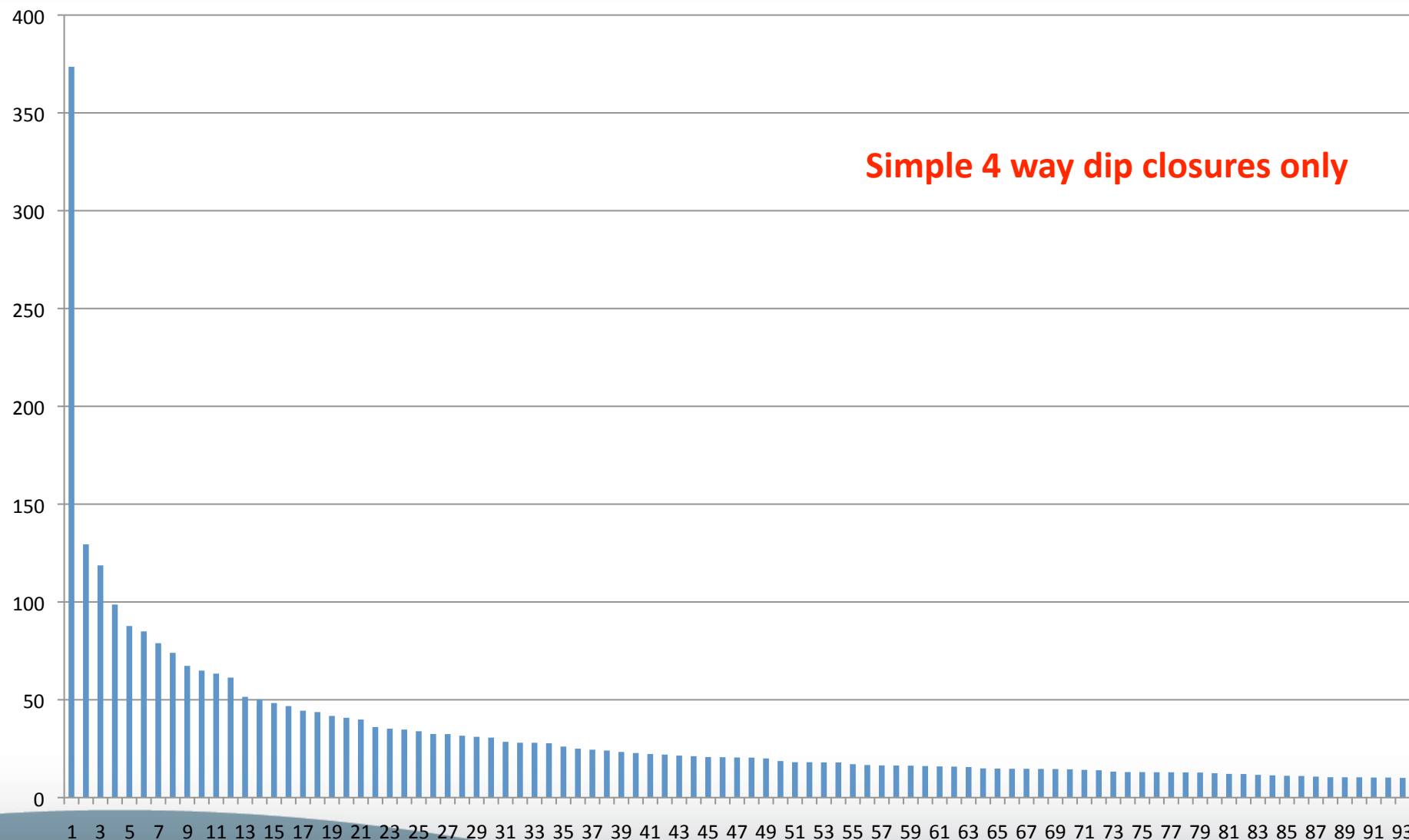
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# Early-Middle Jurassic BRV (Mm<sup>3</sup>)



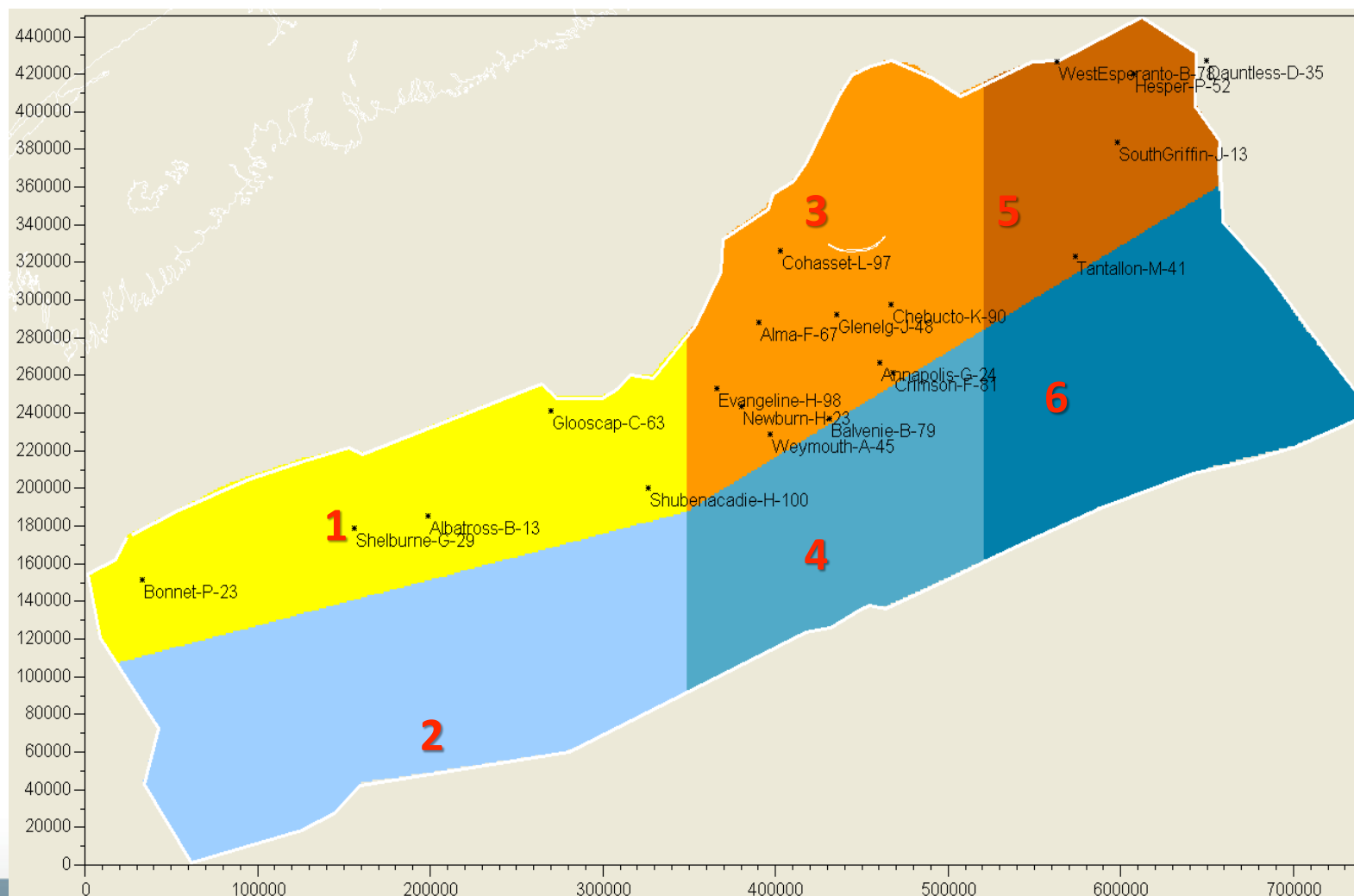
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Simple 4 way dip closures only

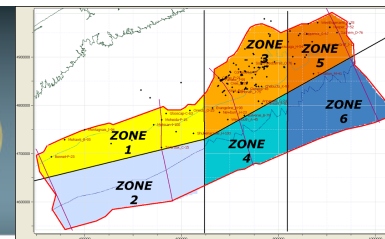


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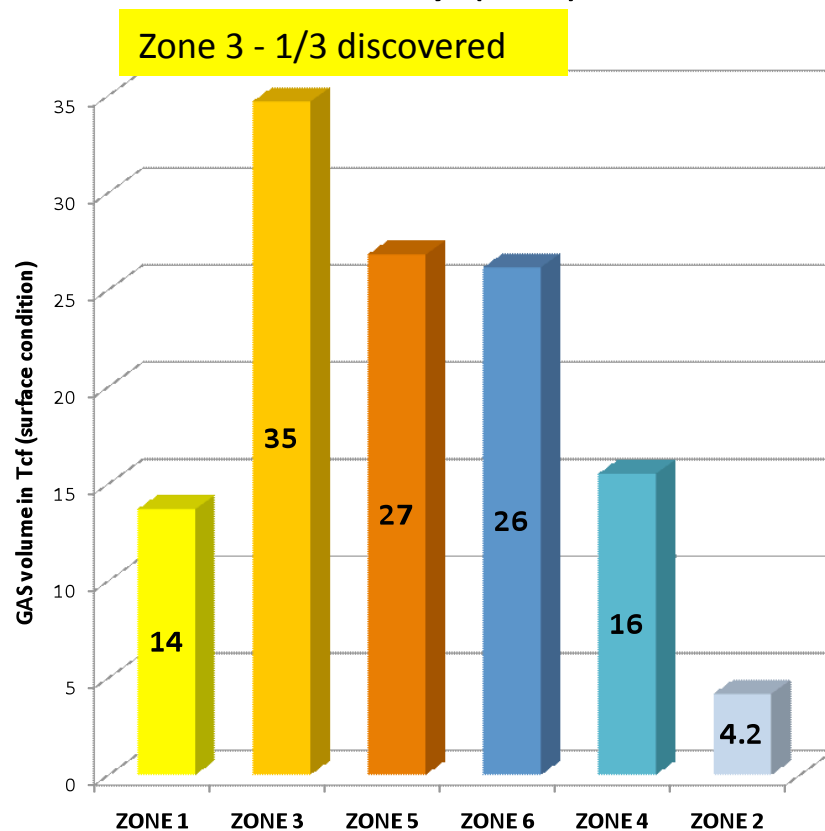
# Zones for volumes analysis



# Ranking of the different zones



**ZONE RANKING by GAS volume IN PLACE**  
**GRAND TOTAL (unrisked)**  
**All Plays (in Tcf)**



**ZONE RANKING by OIL volume IN PLACE**  
**GRAND TOTAL (unrisked)**  
**All Plays (in mmbbls)**

