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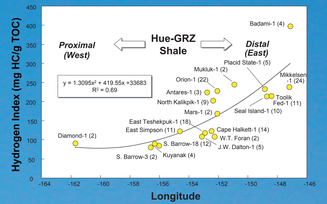
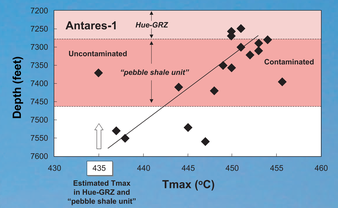
Sheet 5 of 5, Version 1.0

DISCUSSION

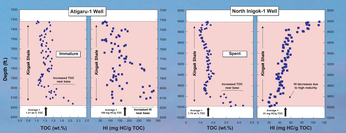
HIo of mature or spent Hue-GRZ was estimated using a systematic west-to-east increase of HI for low-maturity Hue-GRZ that resulted from organofacies changes related to the west-to-east Brookian marine progradation. Values in parentheses indicate the number of Rock-Eval/TOC analyses from each well.



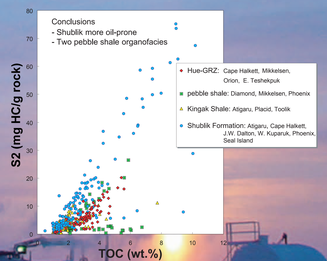
Correction of Tmax: Tmax of Hue-GRZ and pebble shale in the Antares-1 well (see * in tables) was corrected from ~450ºC to ~435ºC based on a reversed depth trend, which may have been caused by well additives (e.g., gilsonite).

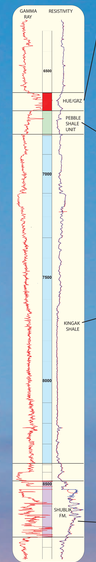


Due to bias introduced by a thick organic-lean portion of the Kingak unit, average TOCo and HIo were not used in PetroMod. Geochemical data support the presence of a 300-foot thick source rock at the base of the Kingak with TOCo and HIo in the range 1-3 wt.% and 100-300 mg HC/g TOC, respectively. Keller (2002) also showed a richer facies at the base of the Kingak from geophysical logs.



Quantity (Rock-Eval S2 and TOC) and quality (slope of S2/TOC) of organic matter (OM) in the Shublik Formation exceed the other source rocks (see also Robison and others, 1996). Quality of organic matter (OM) in the pebble shale unit varies (different S2/TOC trends), as reflected on our maps where TOCo and HIo increase from west to east.





CONCLUSIONS

Hue-GRZ source rock is the distal condensed section of the westerly-sourced Brookian sequence, which overlies the Lower Cretaceous Unconformity. Our TOCo and HIo distributions indicate that the best quantity and quality of OM in this interval occurs in the east, far from significant siliciclastic dilution. Hue-GRZ source rock (208 samples, 33 wells) averages 156 feet thick with TOC and HI of 3.03 wt.% and 174 mg HC/g TOC, respectively.

Hue-GRZ	
Samples	208
Wells	33
Thickness Range (ft.)	29-598
Average Thickness (ft.)	156
% Sampled	55
TOC (wt.%)	3.03
HI (mg HC/g TOC)	174

Pebble shale source rock was deposited during a south-to-north marine transgression. Our TOCo and HIo distributions indicate that the best quantity and quality of OM occurs in the east. The reason for this trend is unclear, but may be related to incomplete data and/or siliciclastic dilution in the west (Keller and Bird, this session). Pebble shale source rock (128 samples, 28 wells) averages 163 feet thick with TOC and HI of 2.84 wt.% and 147 mg HC/g TOC, respectively.

pebble shale	
Samples	128
Wells	28
Thickness Range (ft.)	16-440
Average Thickness (ft.)	163
% Sampled	48
TOC (wt.%)	2.84
HI (mg HC/g TOC)	147

Kingak source rock was deposited during a rifting event as a complex north-to-south progradational succession with multiple sedimentary sections and unconformities. Data averaged over the Kingak interval (546 samples, 27 wells; average thickness = 1418 feet) underestimate its generative potential because low TOC and HI of organic-lean intervals dilute the richer interval that commonly occurs as distal facies in the bottom 300 feet of the shale (see also Keller, 2002). For PetroMod 3D input, we assume a 300-foot thick source rock with TOCo and HIo in the range 1-3 wt.% and 100-300 mg HC/g TOC, respectively.

Kingak	
Samples	546
Wells	27
Thickness Range (ft.)	95-3450
Average Thickness (ft.)	1418
% Sampled	62
TOC (wt.%)	1.97 (1.0-3.0)*
HI (mg HC/g TOC)	145 (100-300)*

*Assumed for 300 ft. of basal Kingak.

Shublik source rock was deposited as shelfal and basinal carbonate. Our TOCo and HIo distributions indicate that the best quantity and quality of OM occur along the axis of the basin to the south, while complex paleogeography in the shelf setting to the north resulted in variable thickness, clastic input, and dilution of the OM. The Shublik source rock (301 samples, 37 wells) averages 216 feet thick with TOCo and HIo of 2.35 wt.% and 292 mg HC/g TOC, respectively.

Shublik	
Samples	301
Wells	37
Thickness Range (ft.)	55-512
Average Thickness (ft.)	216
% Sampled	64
TOC (wt.%)	2.35
HI (mg HC/g TOC)	292

The HIo and TOCo grid input for the four source rocks in this study are critical to the success of our PetroMod 3D modeling efforts (see Lampe and others, this session). These models will help to define the pod of active source rock for each unit, volumes of oil and gas generated, migration paths, and accumulations. They can also be used to validate geochemical oil-to-source rock correlations to more clearly establish petroleum systems. These petroleum system studies are also in progress (see Magoon and others, this session).

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APPENDIX

Mass balance calculations can be used to determine the extent of fractional conversion of kerogen to petroleum and the original TOC of source rocks prior to maturation (G.E. Claypool, pers. comm.; Peters et al., 1996). Two key equations used in this work are:

- Fractional conversion
  $f = 1- HIx\{1200-[HIo/(1-PIo)]\}/HIo\{1200-[HIx/(1-PIx)]\}$
- Original TOC
  $TOCo = 83.33(HIx)TOCx/[HIo(1-f)(83.33-TOCx) + HIx(TOCx)]$

HIx, PIx, TOCx = measured hydrogen index, production index, total organic carbon

HIo, PIo, TOCo = original hydrogen index, production index, total organic carbon

Poster graphics by Zenon Valin

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