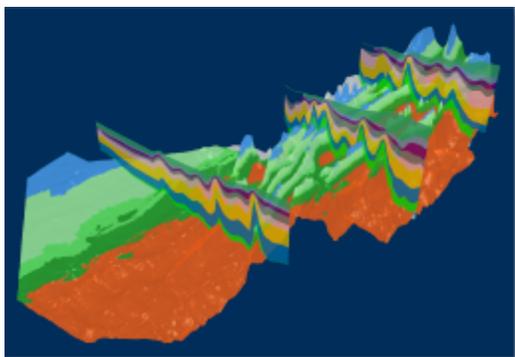


# TRINITY

## Interactive Petroleum System Analysis and Risking

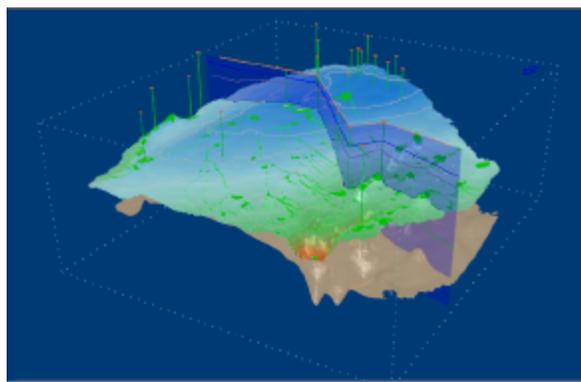
**Trinity** ushers in the next generation of petroleum system analysis. It is a map based tool that allows users to interactively model maturation and migration, calculate charge volumes and composition, predict phase/PVT properties, column heights and reserves, predict pressure accounting for 3D sand geometry. Proprietary algorithms allow Trinity to Monte Carlo the risks involved in charge prediction with mapped variables. Features include map analysis, QC, editing functions, dynamic cross section, instant geohistory and 3D visualization.



### INTERACTIVE MAP DATA ANALYSIS AND MODELING

Make paleo-structure, temperature and maturity property maps at any geological time instantly and integrate the modeling results with all your data in 3D. Everything in Trinity takes only a few seconds. You can spend rest of your day to make changes to your assumptions, and see "what if".

The dynamic cross sections move with the mouse to help understand the relationship between modeling results and the basin.



### FOR GEOLOGISTS BY GEOLOGISTS

The dynamic cross sections are also great tools for QC-ing mapped surfaces. Map editing is like photo editing with a paint-brush tool. Drag and drop to import and integrate various data even if you do not know the format!

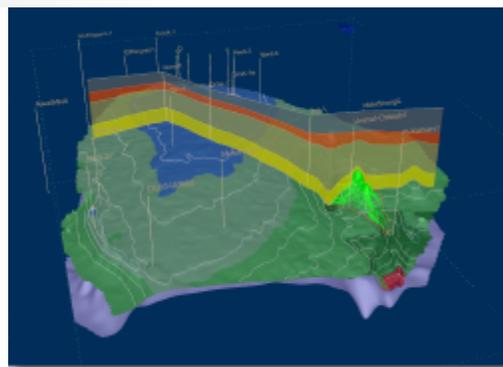
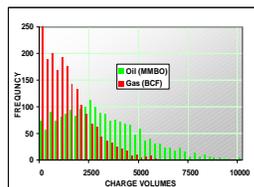
### INTERACTIVE CHARGE ANALYSIS

- 1) Point-n-click to draw the migration path and fetch area for your prospect.
- 2) Push a button to show the expelled volumes and GOR through time.
- 3) Run the flash calculator to predict the volume and phase condition for the prospect.

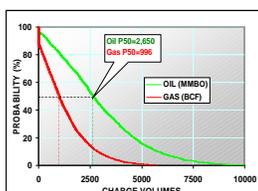
### MAP-BASED CHARGE RISKING

TRINITY uses maps to constrain source rock depth, thickness and fetch area, as well as the burial history at each grid location. Each Monte Carlo realization generates a different map with different source-rock thermal stress implications, and therefore different generated and expelled volumes. Volumes are integrated over the fetch area to give total charge. The figure on the right shows Hanifa maturity with migration paths (green lines) and Fetch area (red line).

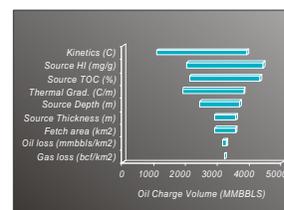
**Volume distribution and probability curves** are generated after 2000 realizations of the risking model. The most likely combined in-place reserves in the domes are about 2.6 billion barrels.



**Probability curves** help quantify the upside (P10) and downside risks (P90) as well as giving us the 80% confidence range, which is desirable for prospect risking.

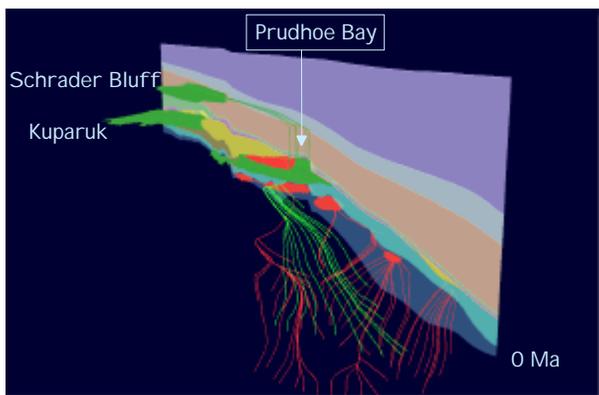


**Tornado diagram** shows which input parameter contributes more to charge volume uncertainty. This tells what the geologist should focus on next in order to reduce the uncertainty in charge prediction.



# TRINITY

## Interactive Petroleum System Analysis and Risking



**INTERACTIVE MIGRATION** Trinity's migration algorithm is so fast that a user can click any source point with the mouse button and watch the hydrocarbons migrate in real time. This example shows how Trinity was used to understand the complex migration and charge history of the North Alaska fields (Leon Dzou et al, 2004).

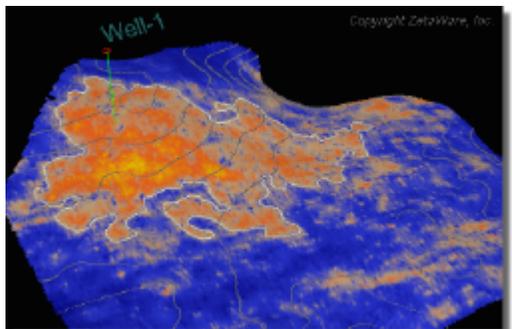
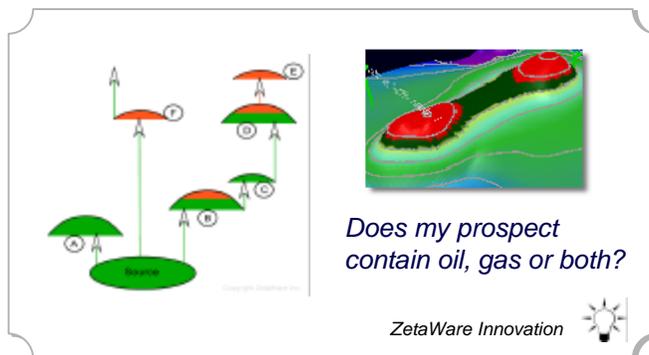
Oil from the HRZ source migrated along a narrow sub-cropped area mixing with oil from Shublik source, while the gas from Kek coal migrating along a deeper horizon leaked into the reservoir. At some stage the mixed fluids leaked up to form the Schrader Bluff field. The Kuparuk field was charged 38 Ma ago from the south via the LCU unconformity.



### MAP-BASED FLASH CALCULATOR

As the diagram shows, a simple medium GOR oil expelled from a typical source rock can lead to entirely different phases in reservoirs due to PVT behavior alone.

Trinity's interactive flash calculator allows explorationists to predict phase properties (oil, gas or oil leg and gas cap) and map the fluid contacts for prospects based on source rock information and/or nearby field information. Watch the fluids contacts change as you adjust T,P conditions. Determines amount and composition of spilled hydrocarbons.



### FLOW BALANCE PRESSURE PREDICTION

Trinity flow balance model determines the "centroid" effects of an arbitrary sand geometry. The flow equation is integrated over the sand area and minimized to solve for the pressure in the sand. Results include sand pressure, and max and min. column height maps.

$$\int K_{sh} \cdot [P_s - P_{sh}] = 0$$

The algorithm is fast enough to be used in Monte Carlo mode to determine the probability of column heights. A joint industry consortium has been formed to further develop this technology.



### ABOUT ZETAWARE

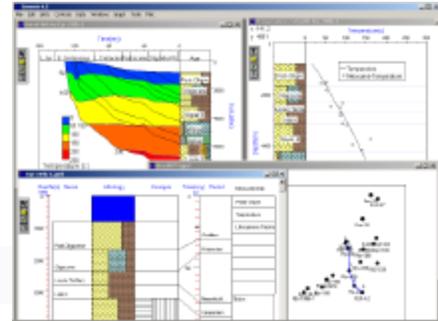
ZetaWare is a leading provider of interactive software tools and innovative solutions for analyzing the risks associated with petroleum prospects for exploration. Many of our innovative solutions are adopted by major oil companies. ZetaWare's technology innovations include map-based charge risking, map-based Interactive flash calculator for exploration and flow balance pressure prediction. Innovations such as dynamic cross sections, paint-brush map editing, and drag-and-drop file importing are raising the expectations of users and setting new industry standards for user-friendly software.

ZetaWare's customers include all tiers of the oil industry from small independents to some of the world's largest oil and gas companies.

# GENESIS

## Easy to Use, Advanced Basin Modeling

**GENESIS** is an easy to use, powerful 1D basin modeling software. Formerly developed at ARCO, it won the prestigious Outstanding Technical Achievement Award. It has many technical advances not found in other commercial 1D models. For example, its full lithosphere thermal model allows prediction of heat flow away from well control and through geological time. The improved rifting model better explains the observed maturity in rift basins. Genesis works with Trinity to become part of your complete petroleum systems workflow.

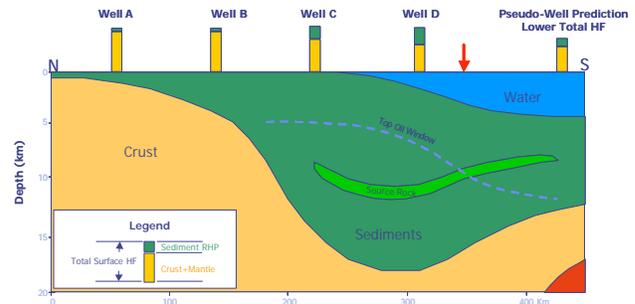


### FEATURES

- ✓ Advanced yet easy-to-use 1D basin modeling and petroleum system analysis tool.
- ✓ Basin burial, compaction, pressure, temperature and hydrocarbon generation history.
- ✓ Compaction dis-equilibrium, pressure, quartz cementation and reservoir quality analysis.
- ✓ Interactive: All data input are graphically displayed as user edits them. User visually builds a strat-column rather than a table of numbers so error is minimized. Calculations take only seconds, allowing quick what-if scenarios.
- ✓ Extensible: User can customize all the default parameters, rock properties, flow models, directly through the intuitive interface.
- ✓ Robust: Helps prevent user from building geologically incorrect model.

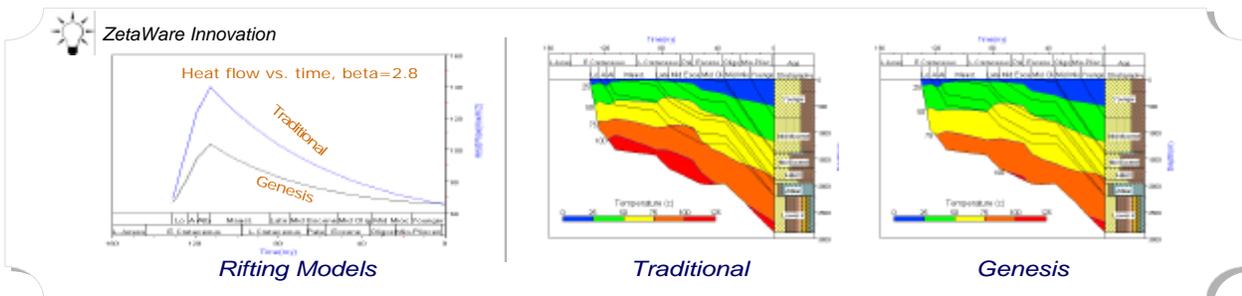
### PREDICT HEAT FLOW AWAY FROM WELLS

Genesis, can use a constant temperature boundary condition at base of lithosphere. The advantage is that once the model is calibrated with temperature data at the well location, we can then use the same boundary condition varying only the geology. The heat-flow variation beyond well control, and in the geological past, are automatically determined. This example shows how heat flow is predicted for the offshore from onshore calibration.



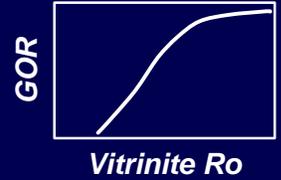
### IMPROVED RIFTING MODEL

The typical implementation of McKenzie's model over-predicts heat flow during rifting event in Campos basin and incorrectly puts timing of hydrocarbon generation before trap formation. Genesis can model the loss of radiogenic heat production due to crust thinning, allowing for consistency with observed data and provides more appropriate timing for generation allowing for better exploration risk characterization.



# KINEX

## Powerful, One-Click Source Rock Modeling Tool

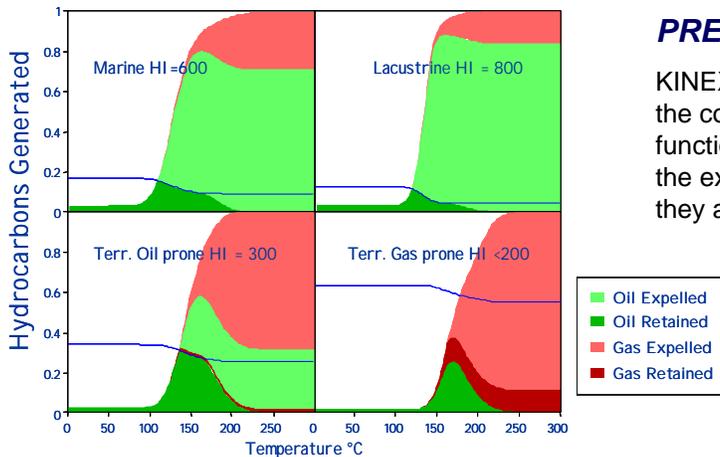
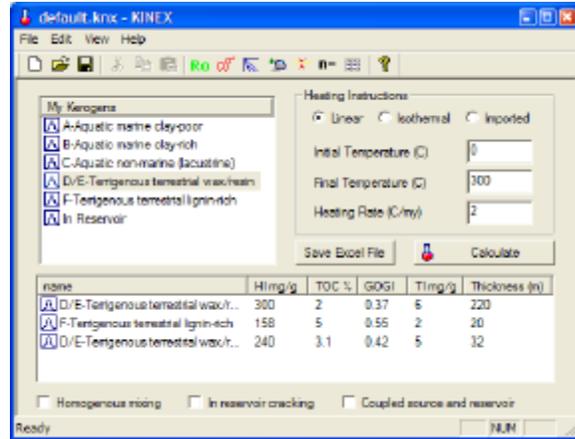


**KINEX** is the “one-click” source rock maturation modeling tool for predicting expelled products and GOR from a source rock with inter-bedded organo-facies ( geochemical log). It features drag and drop interactivity and professional graphical output. Over 40 different maturation parameters are predicted including oil and gas expelled, GOR, vitrinite reflectance, and properties of expelled products such as density and interfacial tension.

### SOURCE ROCK VARIABILITY

Source rocks are rarely uniform. The vertical quality (HI, TOC) variations within the source interval have significant impact on the composition and timing of hydrocarbons expelled. Averaging source properties gives a different composition and timing than if the sub intervals are modeled discretely.

For example, a source rock with 50 m of 600 HI marine and 50 m of 200 HI deltaic facies does not behave like a source rock with 400 HI in the expelled products and timing.



### PREDICT CHARGE COMPOSITION

KINEX models multiple stacked source facies to predict the composition and the timing of expelled products as a function of the geochemical profile. This figure shows the expulsion behaviors of typical source facies when they are modeled separately.

Blue lines on graph indicates expulsion threshold, which varies with maturity. This figure explains why source rock with 200 Hydrogen index generates about 50% oil but expels only gas.

### FEATURES

- ✓ Easy to use, one-click interface.
- ✓ Variable sorption expulsion model. Sorption capacity a function of maturity.
- ✓ Capability to model mixed facies, in-reservoir cracking and in-source accumulations.
- ✓ Over 40 different maturation parameters are predicted including oil and gas expelled, GOR, vitrinite reflectance, and properties of expelled products such as density and interfacial tension.
- ✓ Fully interactive, calculation takes less than a second, allowing quick what-if scenarios.
- ✓ Cross plot any number of parameters against another
- ✓ Professional graphics to paste into your presentation documents