Science Camp #170802.8

02-04 August 2016 @ the Condo, the Nelson Cabin, and surrounding area

Advisors

H. Roice Nelson, Jr., Andrea S. Nelson,
Paul F. Nelson, Benjamin B. Nelson

Attendees

Ethan E. Nelson, Grant M. Nelson, Colby C. Wright,
Taylor R. Wright, Ella D. Nelson, Halle N. Wright,
Bobbie Sophia Waldron, Dallin Spencer Nelson,
Avalyn Joyce Wright, Rachel Lee, & Ian Lee

3-D Acquisition Design

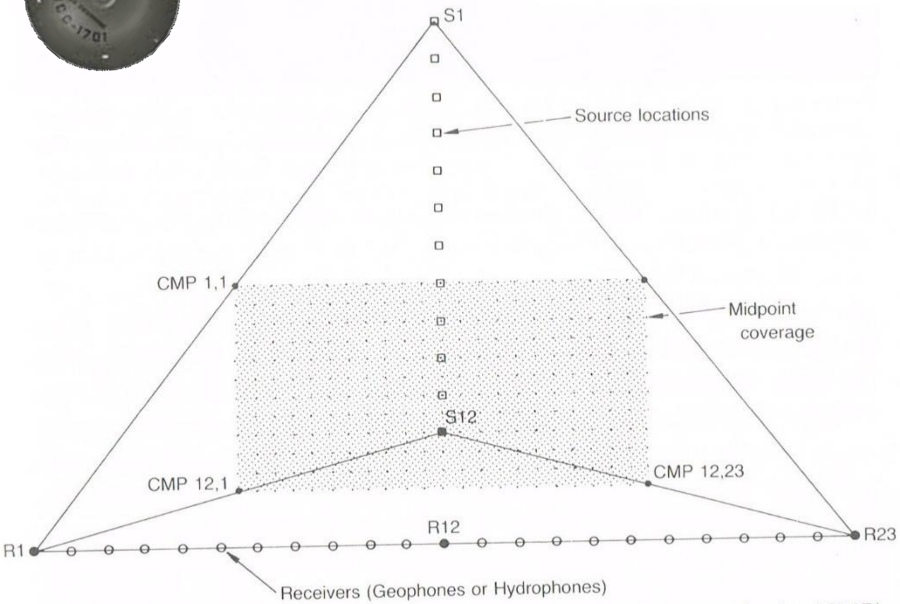


Figure 4-2. Cross-spread or T-spread data collection provides common mid-point (CMP) traces that cover an area. The T-spread is the simplest reduction of a 3D collection scheme, and can be expanded by running the receivers or sources in any arbitrary direction.

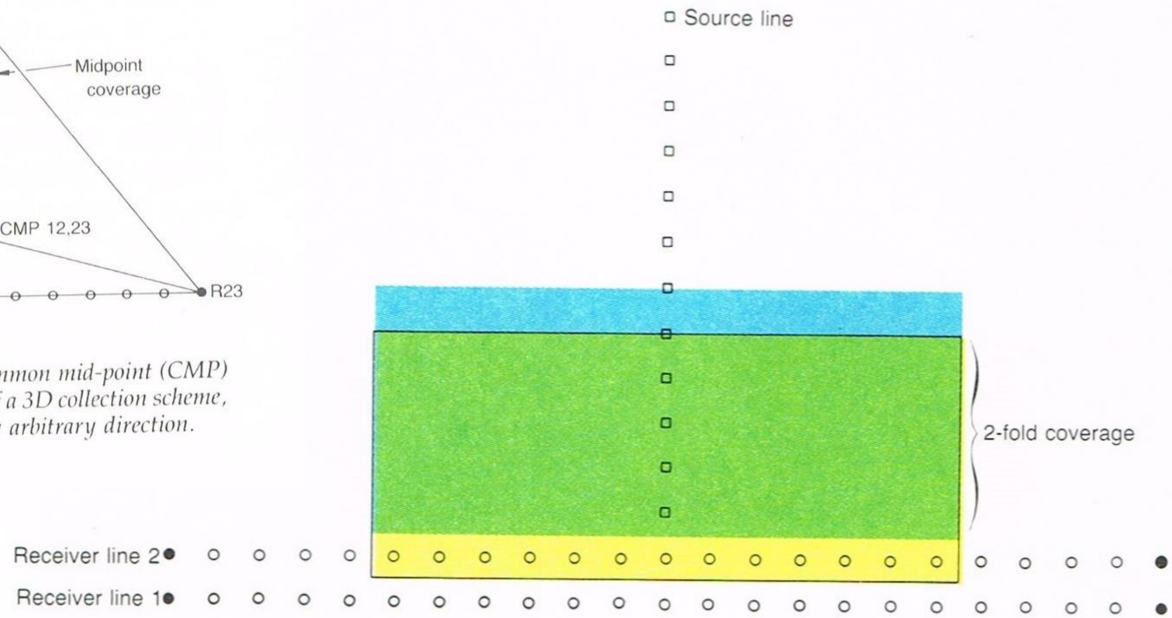


Figure 4-5. By shooting multiple source lines into the same receiver array, any desired CMP redundancy can be achieved. In the example above there is 2-fold coverage in the overlapped area and single fold coverage elsewhere. When there are two traces with different offsets at the same CMP, the data is referred to as 2-fold. Most 2D data collected today is 24, 48 or 96-fold, and by adding this redundant data together it improves the

http://www.walden3d.com/photos/Grandkids_Science_Camps/170802-04_Science_Camp/7_3-D_Seismic_Modeling.pdf

3D Acquisition Design & CMP Display

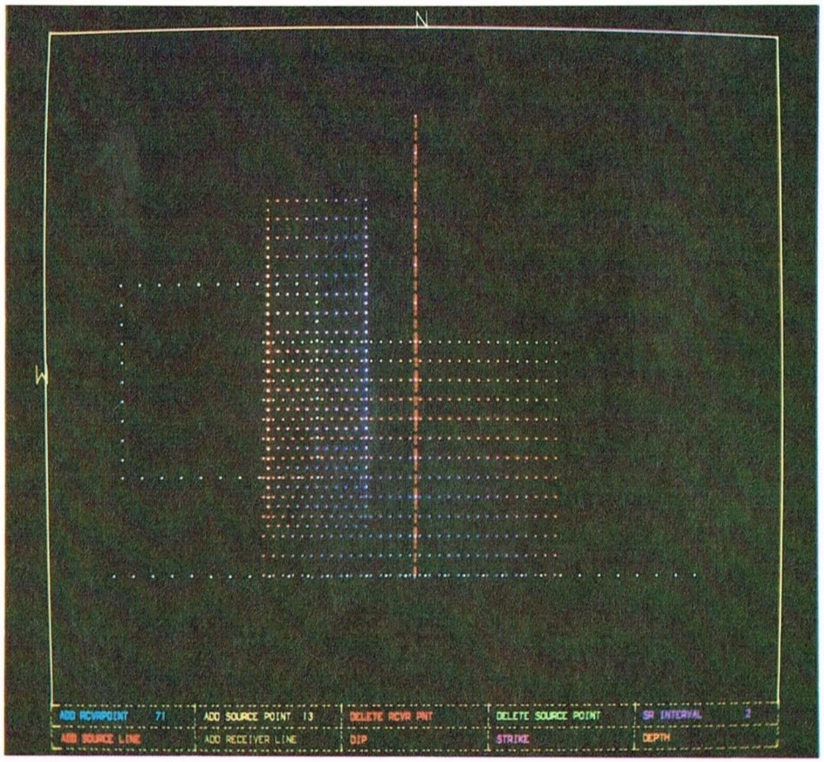


Figure 4-3. A map or aerial view of shot and receiver positions for a typical 3D survey shows the spatial relationship to generated CMP's. The shot points are marked in red along the vertical part of the X-spread. Receiver locations are marked in white, and are along both arms of the X-spread, as well as on the perimeter of a small square off to the north-west. The CMP's fall in between and are color coded by offset. (Courtesy Geosource, Petty-Ray Geophysical Division.)

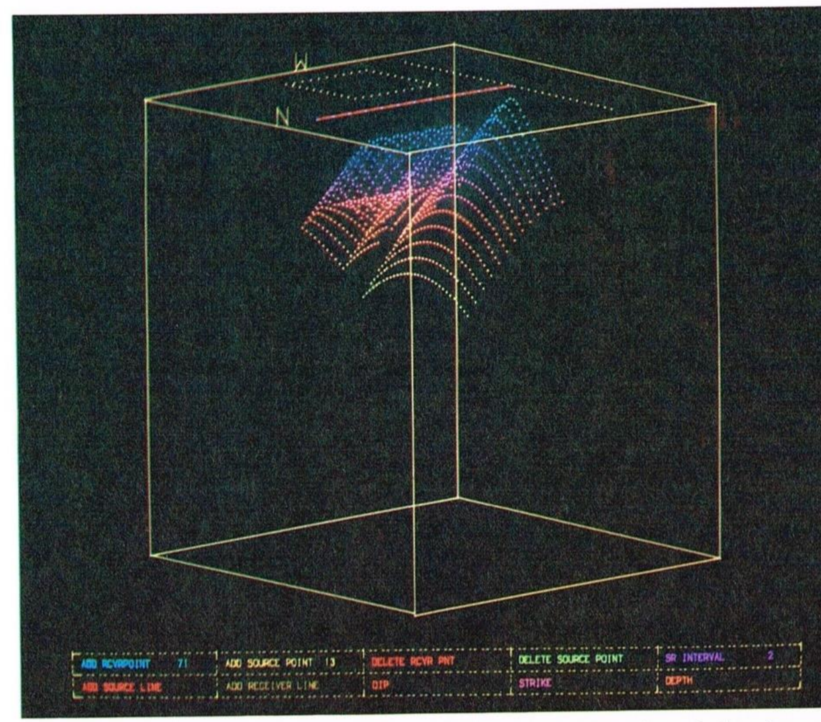


Figure 4-4. The offset differences for different CMP's are visually enhanced when the same information is displayed with offset shown as a function of required NMO correction along the z-axis. With an interactive display device, it is easy to rotate, translate, or scale this display to any desired orientation. (Courtesy Geosource, Petty-Ray Geophysical Division.)

Wedge Numerical and Physical Model

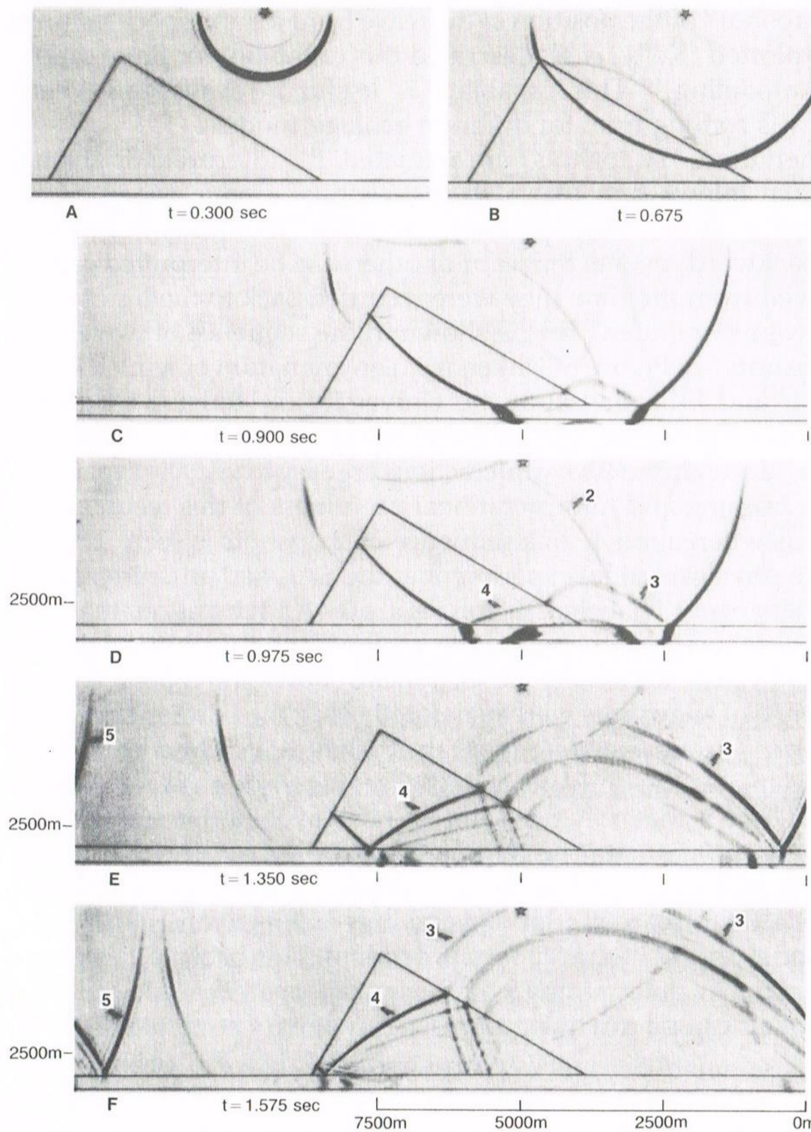
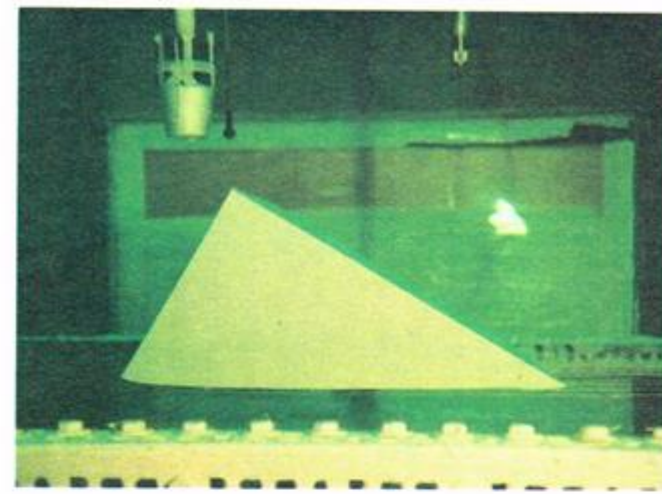


Figure 6-3. A sequence of wavefront "snapshots" calculated using the Kosloff, Baysal Fourier modeling technique. The pressure response is calculated at specific time steps and then the snapshots are "animated" to help interpret specific events. Event 2 is reflected energy off of the low-velocity wedge. Events 3 and 4 are reflected energy off of the high-velocity flat base. Event 5 is wrap-around due to the Fourier transforms used in this method. (After Kosloff and Baysal.)



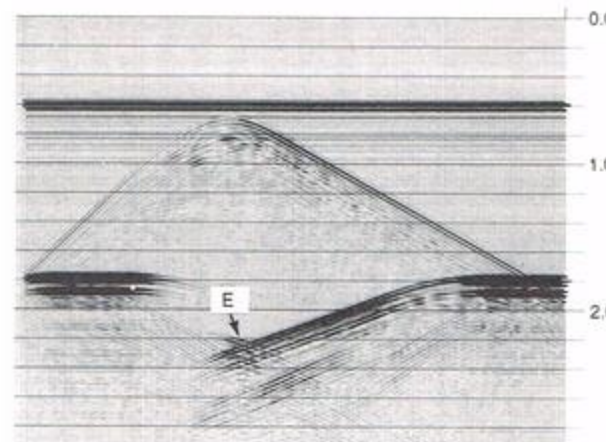


Figure 6-4. A 2D wedge physical model is shown accompanied by a seismic section across the model. Event E, the "mystery event on the physical model section, is the diffraction energy from the top of the wedge.

Fresnel & HCI Models

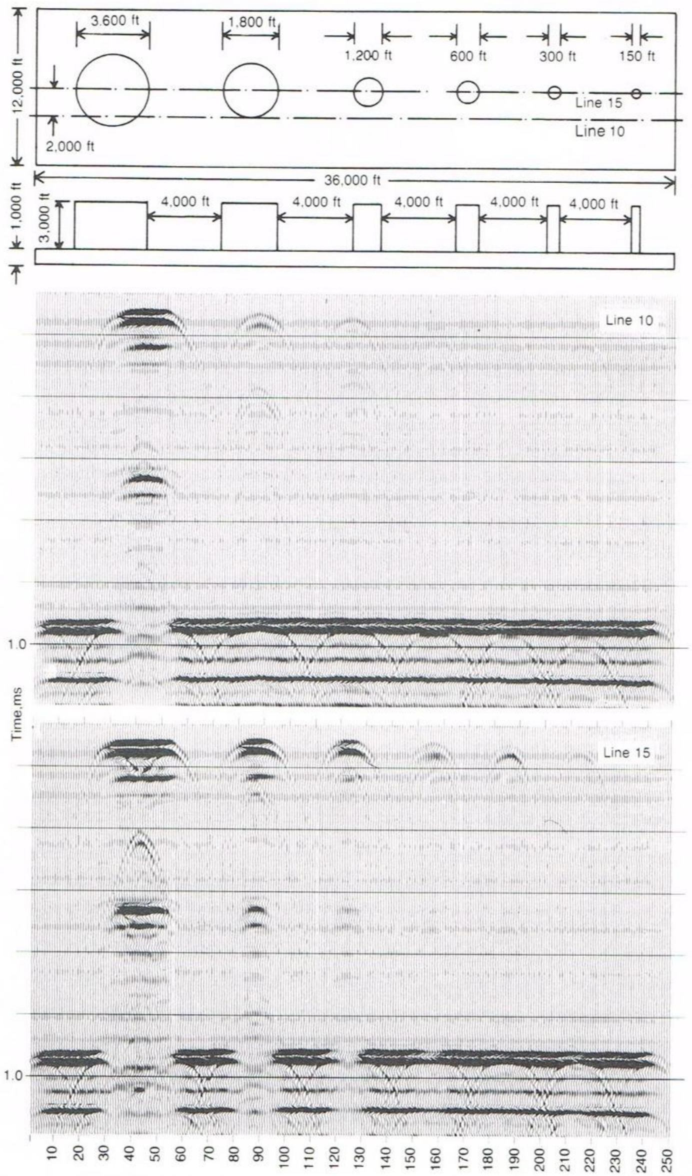


Figure 6-9. A map view (including section locations) and side view of physical model SALFRS is shown. Note the expected response on the seismic section for Line 15 as the cylinders get smaller. The 2,000-ft separation between the sections shows the importance of proper spatial sampling in order to see events that can indicate significant hydrocarbon prospects.[22]

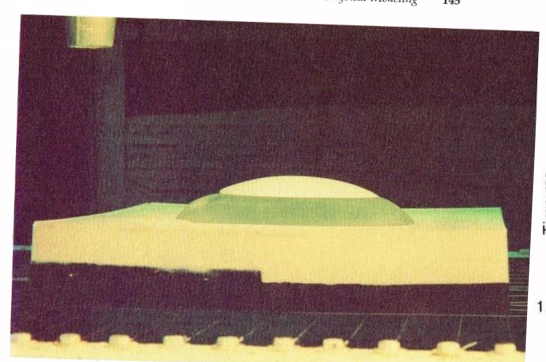


Figure 6-10. The 3D model SALHCI is shown in the water tank.

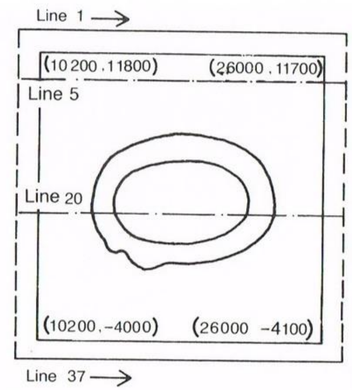
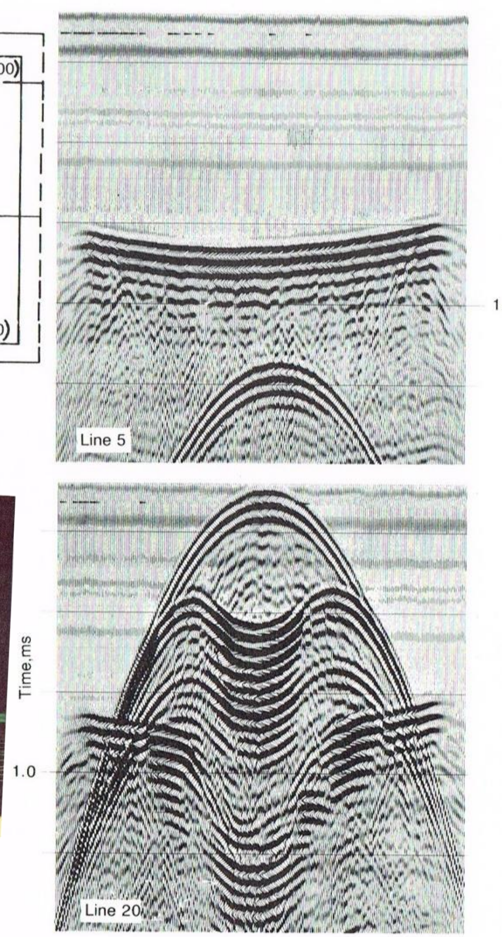



Figure 6-11. A map view of the SALHCI model is shown with two seismic lines referenced. Seismic sections for each of the lines are illustrated. Note the sideswipe from the model edge as indicated in the section for Line 5. The velocity push-down from the low velocity (gas) cap is shown in the section from Line 20.[23]

SALNEL
Alluvial Stream Model

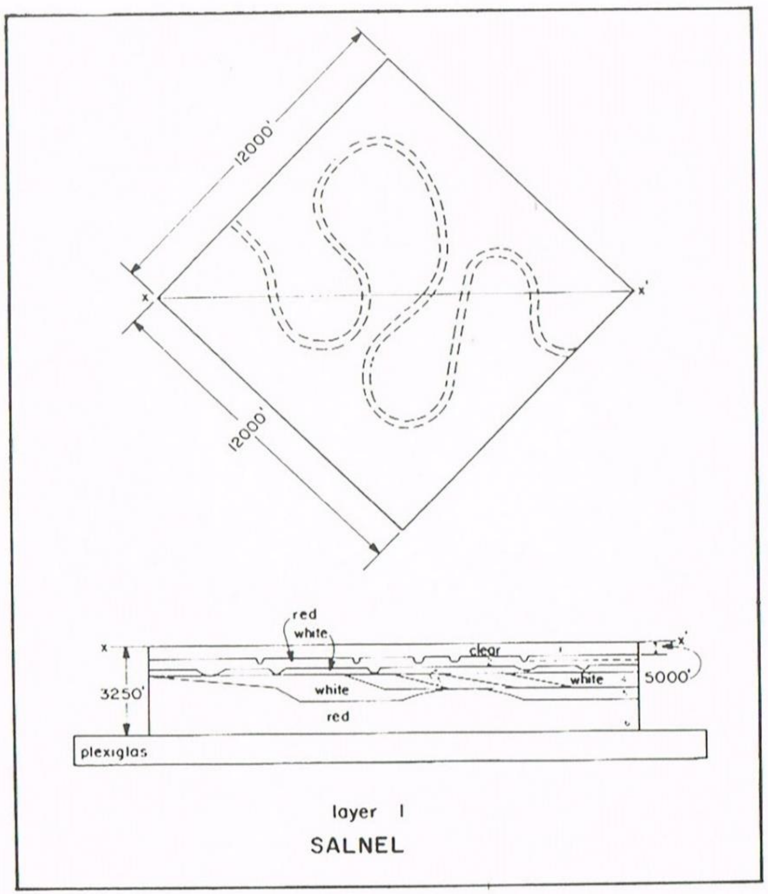


Figure 6-12A. Line drawing of SALNEL showing the six different layers represented by the model.[25]

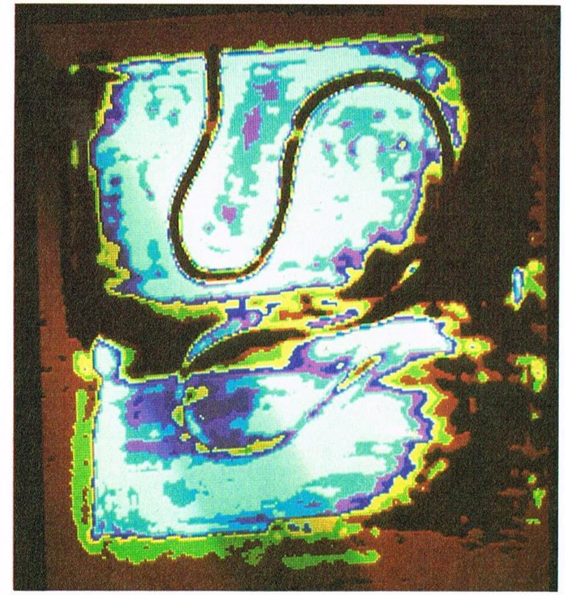


Figure 6-12B. Time-slice or horizontal section through the SALNEL meandering stream.

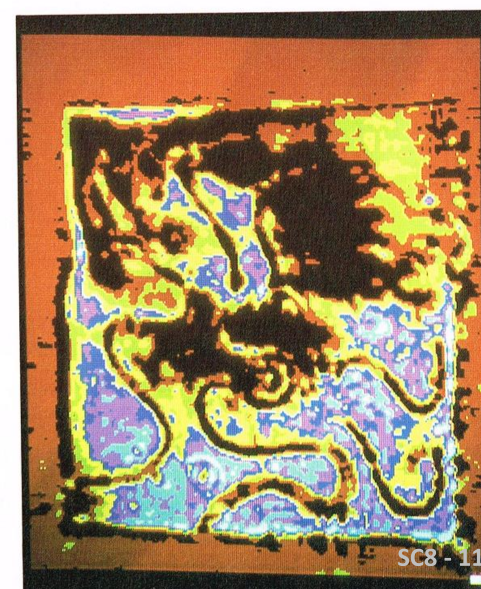


Figure 6-12C. Time-slice or horizontal section through the SALNEL braided streams.

3D Display & Migration Lens Model

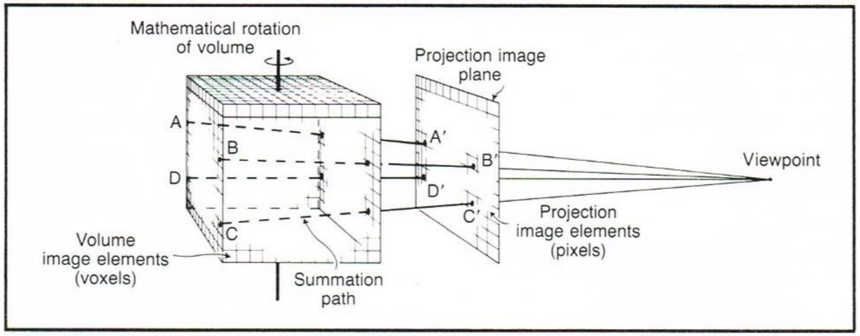


Figure 8-4. Picture elements (voxels) of the volume on the left are numerically summed along projection paths (four representative paths shown) to form the picture elements (pixels) of the two-dimensional projection image in the center. When the resulting digital image is displayed, it is as though the observer views the volume image from the viewpoint on the right. (Reproduced from SEG Reprint,[22] Courtesy L.D. Harris, "Identification of the Optimal Orientation of Oblique Sections Through Multiple Parallel CT Images," Journal of Computer Assisted Tomography)

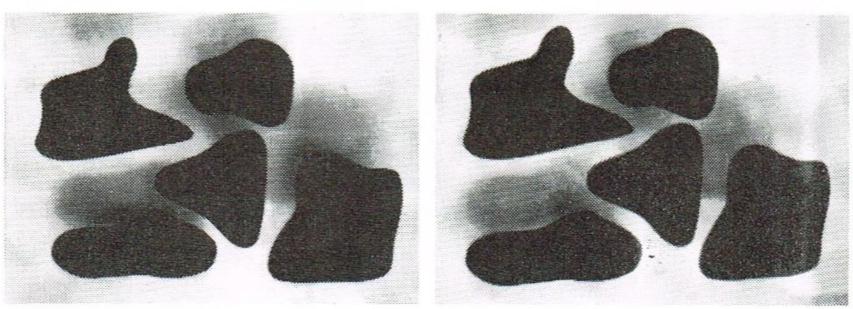


Figure 8-5. Stereoscopic photograph of a physical model with five plexiglass lenses raised above a plexiglass base. The highest lens is in the bottom right corner, they stairstep down to the top left corner lens, and the bottom left and top right lenses are lowest and are at the same elevation.[23]

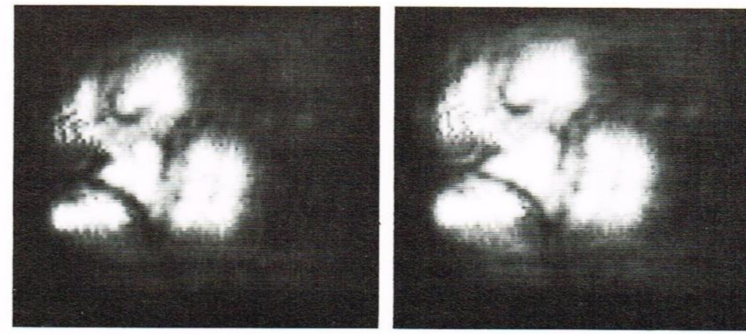


Figure 8-6. A stereoscopic projection of a volume of unprocessed seismic data over the physical model from Figure 8-5. Note the unfocused appearance caused by the diffractions.[23]

Figure 8-7. A stereoscopic projection of a volume of Hilbert Transformed 3D migrated data from the physical model in Figure 8-5. Note the focusing effect of migration compared to Figure 8-6.[24]

SALNOR Model of Norwegian North Sea Geology

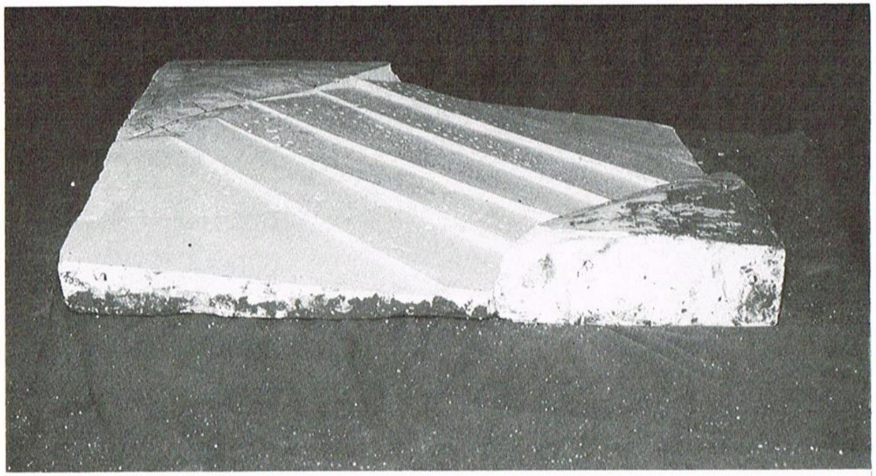


Figure 6-13B. A view of the SALNOR J-Unconformity plaster cast after it was shaved off to the Base Statfjord horizon.

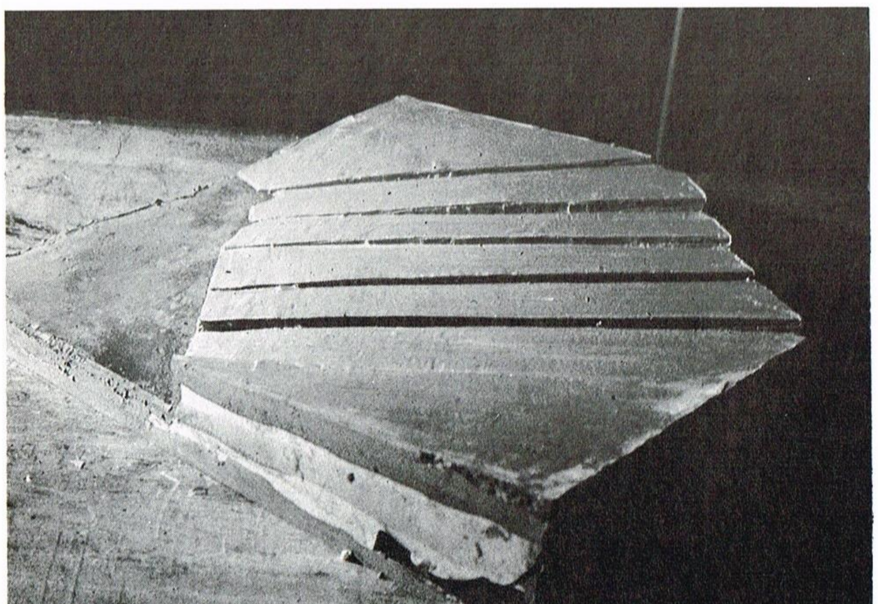


Figure 6-13C. The silicon rubber for deeper layers was added by pouring between the model and the plaster cast. This shows the SALNOR model after the Statfjord horizon had been poured.

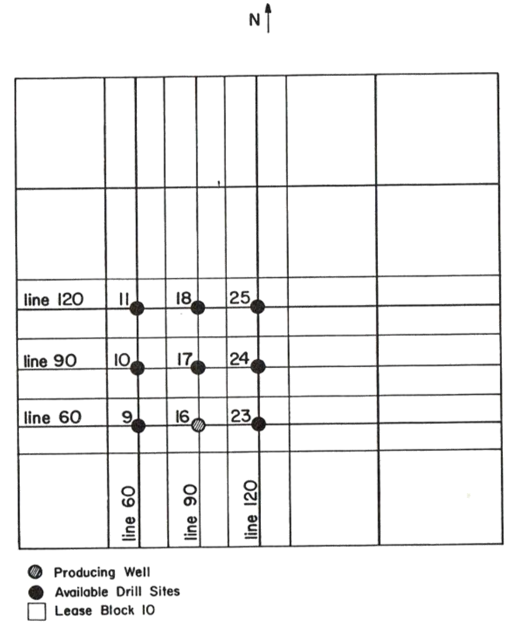


Figure 6–13F. A map showing the relationship of 7 north-south, 7 east-west, and 9 possible drilling locations. This is part of an interpretation training exercise.

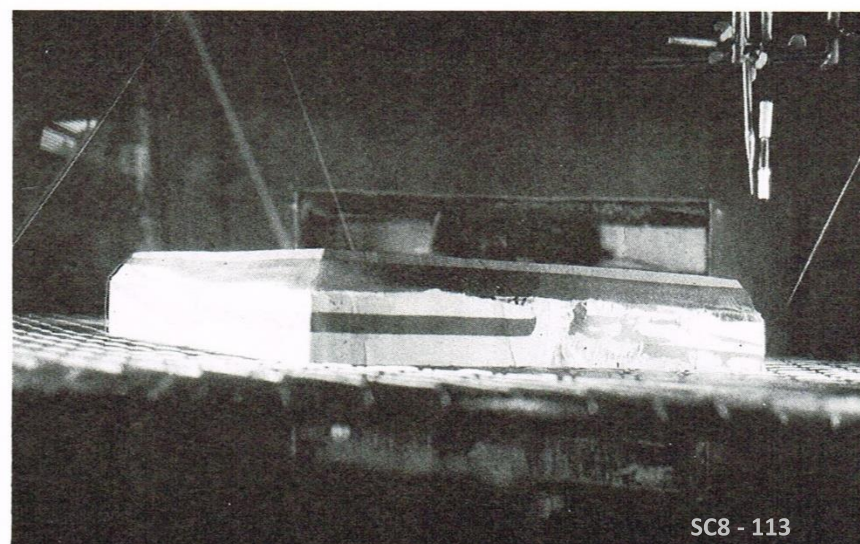


Figure 6-13A. The completed SALNOR physical model in the modeling tank.

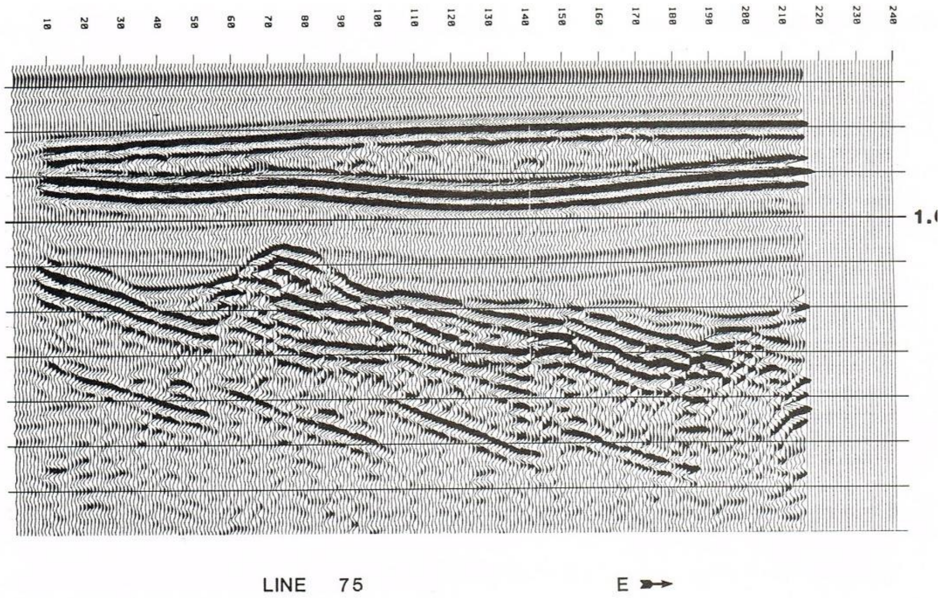


Figure 6–13D. An east-west vertical seismic section across the SALNOR model. The top three horizons represent the Top Paleocene, Top Cretaceous, and J-Unconformity. The other horizon easily recognized, which has four faults, is the Base Statfjord horizon.

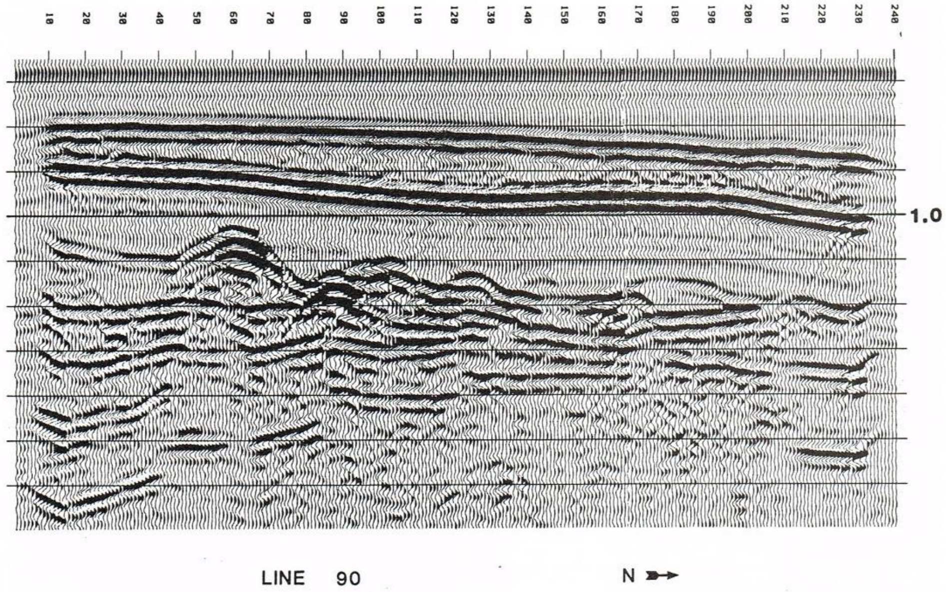


Figure 6–13E. A north-south vertical seismic section across the SALNOR model. The same horizons noted in Figure 6–13D can be recognized. On the left side, the Top and Base Brent and Top and Base Statfjord are also easily seen.

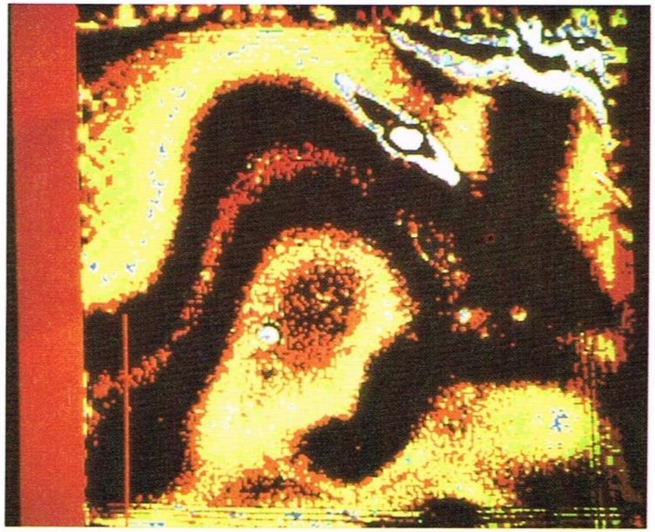


Figure 6–13G. A horizontal seismic section from a 3D survey collected across the North Sea physical model. The time-slice section is at 1.06 seconds and cuts the J-Unconformity structural highs.

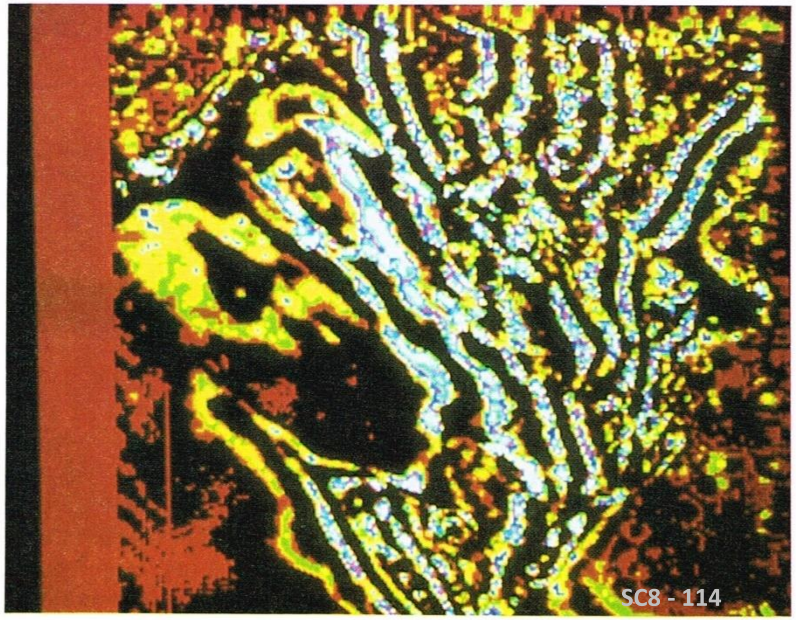


Figure 6–13H. A time-slice section from the same SALNOR 3D survey at time 1.22 seconds. At this depth the section cuts through the two dipping, producing Brent and Statfjord sandstones. The fault cuts are easily identified, especially when a sequence of time-slices are animated like a movie.

Notes

2017 Science Camp

- What was best about 2017 Science Camp?
  - ______________________________
  - ______________________________
  - ______________________________

- What would be your ideal 2018 Science Camp Theme?
  - ______________________________
  - ______________________________
  - ______________________________