PRAKLA-SEISMOS INFORMATION No. 67

COMSEIS® with Integrated SATTLEGGER Software

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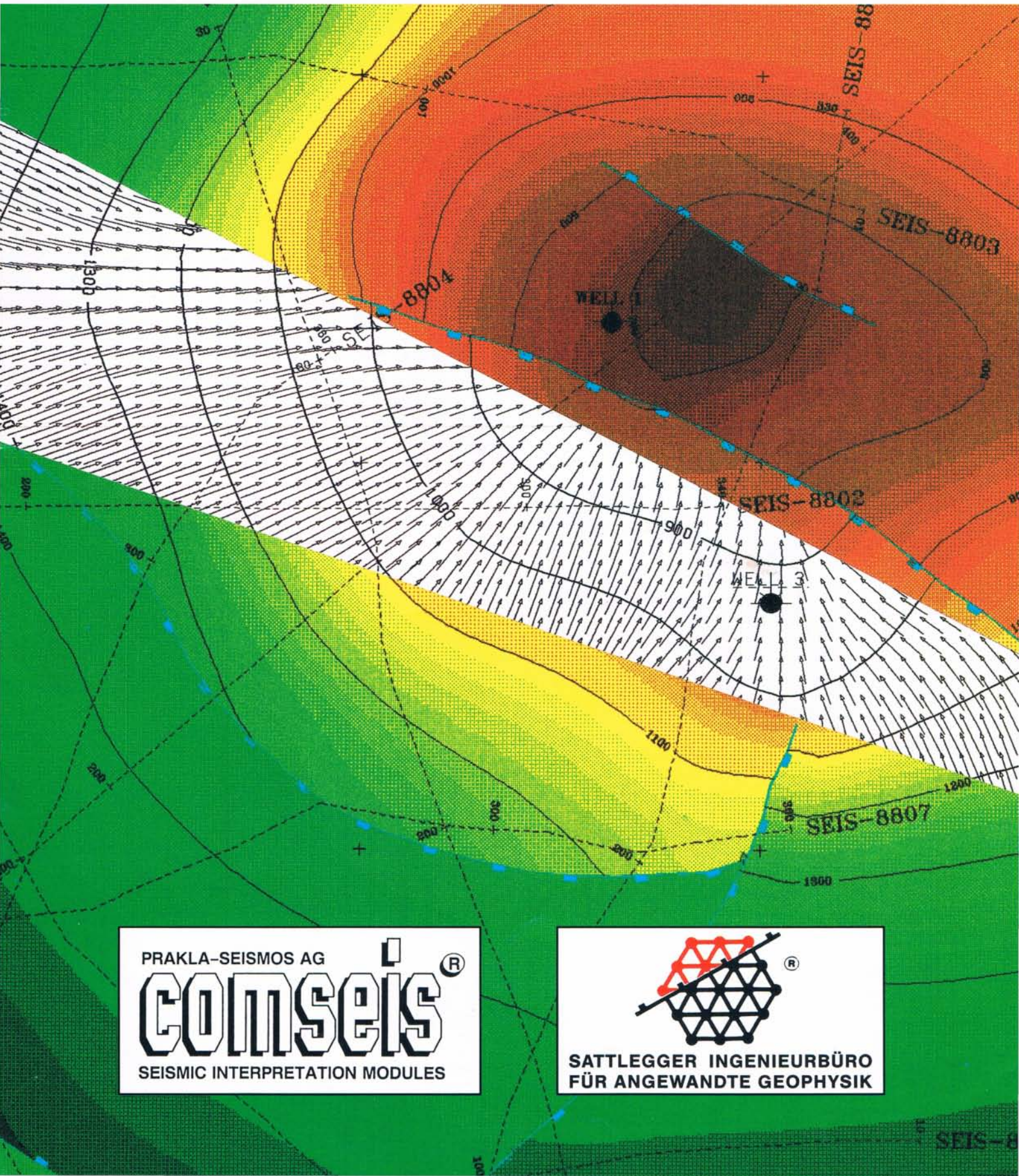


PRAKLA-SEISMOS AG

comseis®

SEISMIC INTERPRETATION MODULES

SATTLEGGER INGENIEURBÜRO
FÜR ANGEWANDTE GEOPHYSIK

COMSEIS-Workstation

The **Computer-Aided Seismic Interpretation System COMSEIS®** developed by **PRAKLA-SEISMOS AG in Hannover** came on the market in 1984 and since then has been enjoying increasing acceptance throughout the European Mainland.
The COMSEIS® interpretation system was already presented in earlier PRAKLA-SEISMOS INFORMATION brochures.
Software components of the COMSEIS® system include

- Interpretation of 2D seismic areas
- Interpretation of 3D seismic areas
- Well data processing including log processing and well modeling
- Geological interpretation
- The mapping system
- 2D horizon migration / modeling and 3D map migration / modeling

Successful integration of software from the **SATTLEGGER Ingenieurbüro für Angewandte Geophysik in Meppen** has resulted in yet a further increase in the capabilities of the COMSEIS® interpretation system (see Fig. 9 on the back cover). COMSEIS® users now have at their disposal well established SATTLEGGER programs

- 2D horizon migration and modeling (HMIG 99)
- 3D map migration and modeling (SUSI)

Both these programs are essential components of the **ISP 003 (Interpretive Seismic Processing System)**, a sophisticated program system which the SATTLEGGER Ingenieurbüro started developing in 1974.

The SATTLEGGER map migration and modeling package is fully integrated into the COMSEIS® system, whereas the HMIG 99 program is presently connected via an interface.

3D Map Migration / Modeling fully integrated into the COMSEIS®-System

The COMSEIS® MAPPING Module

The 3D map migration and modeling programs from SATTLEGGER have been completely integrated in the dialogue and the database system of the COMSEIS® MAPPING module (see Fig. 1). This has resulted in a marked increase of the mapping functionality. The mapping system now includes the following submodules:

- Basemap Module
- Posted Map Module
- Grid Module TASH
- 3D Map Migration / Modeling
- Contour Map Module
- Colour Map Module

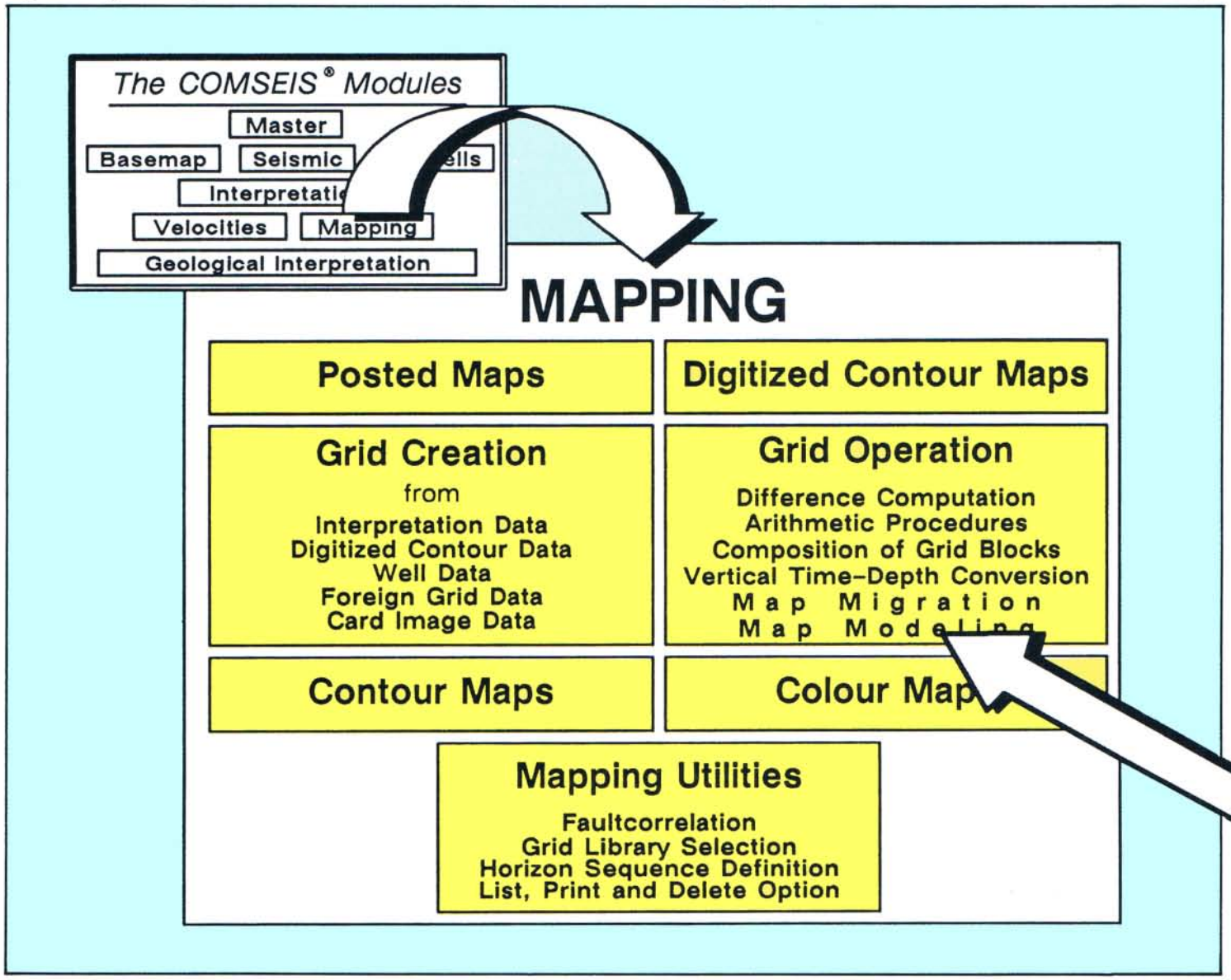
The MAPPING module enables digital surface models to be calculated for the interpreted seismic reflectors. These grids can be subsequently displayed in the form of contour maps.

If three-dimensional migrated seismic data are available for interpretation then the time grids are subjected to a vertical depth conversion by means of a grid operation.

If stacked seismic data are available for interpretation then the interpreted data on a time grid can be depth converted via the 3D Map Migration from SATTLEGGER.

The Mapping package has additionally a number of options for handling the surface grid, for generating posted maps and digitized contour maps, as well as for correlating faults and so on.

Fig. 1: Integration of the SATTLEGGER 3D map migration and modeling program into the COMSEIS® MAPPING module



3D Map Migration and Modeling in COMSEIS®

The program package SUSI (Surface Sampling and Interpolation System) from SATTLEGGER has been fully integrated into COMSEIS® for map migration and map modeling. It operates directly on the rectangular grids in the COMSEIS® database.

Map migration uses an algorithm derived from the Fermat's principle and from the Helmholtz-Kirchhoff equation.

Migration for calculating the depth grid is carried out successively from top to bottom through the horizons.

The individual horizon velocity intervals can be defined by means of a number of velocity functions available. A linear function or a Faust root function is in most cases adequate. It is also possible to input velocities with lateral variations and law parameters in the form of grids. To achieve this, velocity contour maps are digitized using a contour line editor and subsequently processed to a grid by the TASH program.

The contour line editor also enables velocity values and their functions to be calculated from well data. The individual data points are then available at the well locations and can be supplemented by digitized fixed points and contour lines.

Horizon data containing little or no faulting can be migrated in a single sweep. Should the data contain faults which show large throws then the horizons have to be divided up into individual blocks. These blocks are migrated separately. The associated fault lines are transformed with the aid of the displacement vectors (Fig. 2) which are determined during migration. Finally the migrated blocks are connected to a single depth grid.

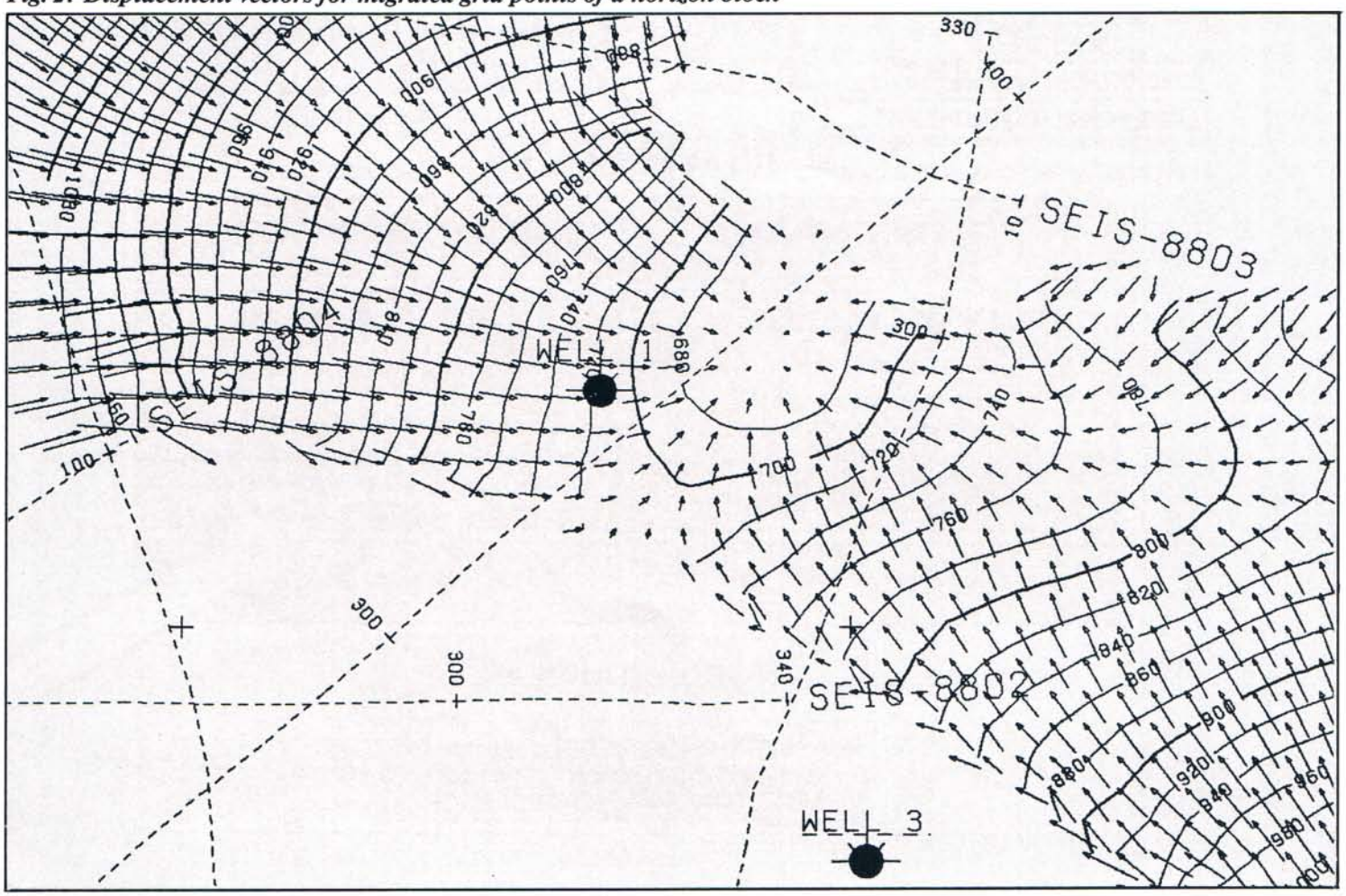
The following operations can be all interactively carried out:

- Separation of subgrids within a horizon (block splitting) for migration
- Editing of faults after fault transformation
- Combining of the grid blocks after migration
- Grid value display and editing
- Partial smoothing of a grid
- Interpolation of small gaps in a grid

A comparison of a time contour map with its corresponding depth contour map after map migration is shown in Figs. 3 and 4.

Map modeling is exactly the inverse of map migration. The depth grids are converted into modelled time grids analogous to the migration principle.

Fig. 2: Displacement vectors for migrated grid points of a horizon block



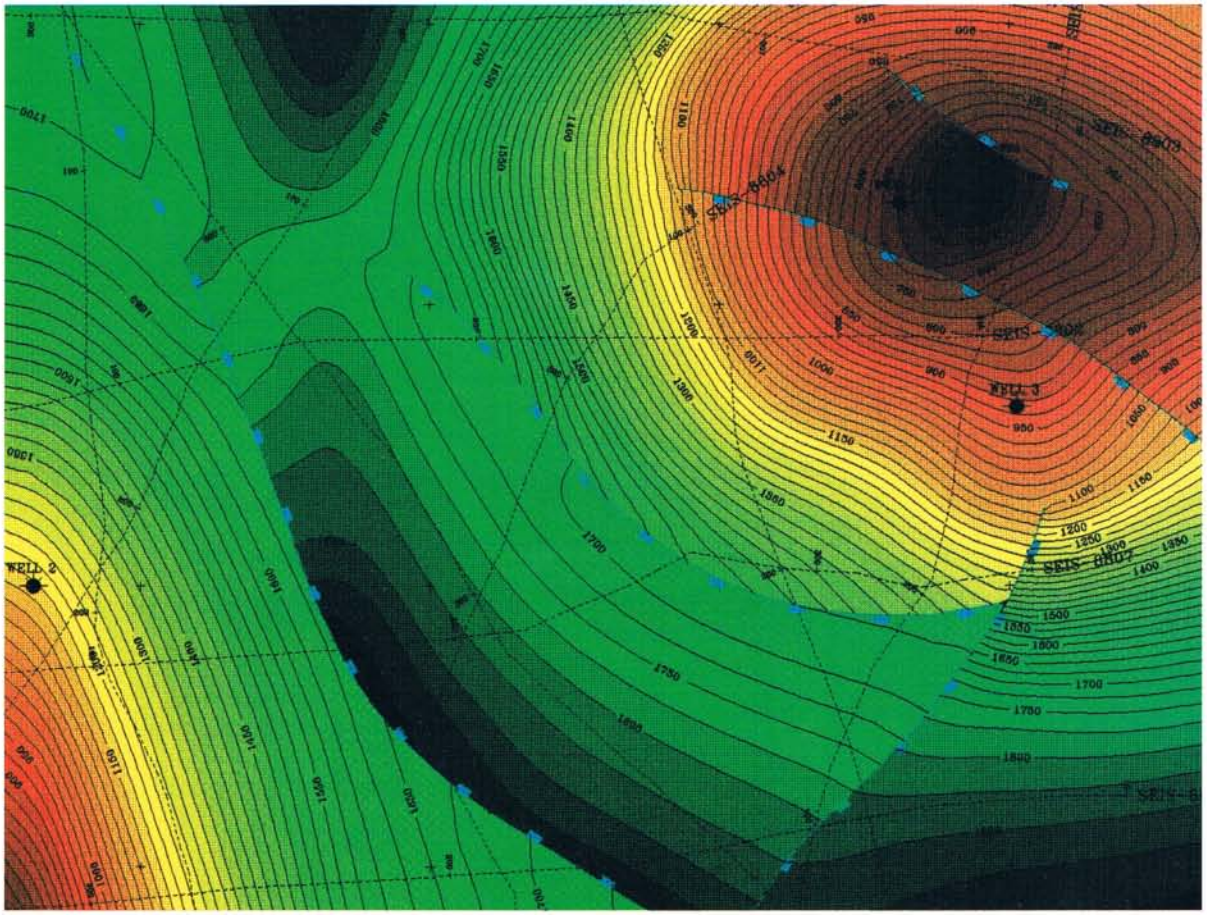
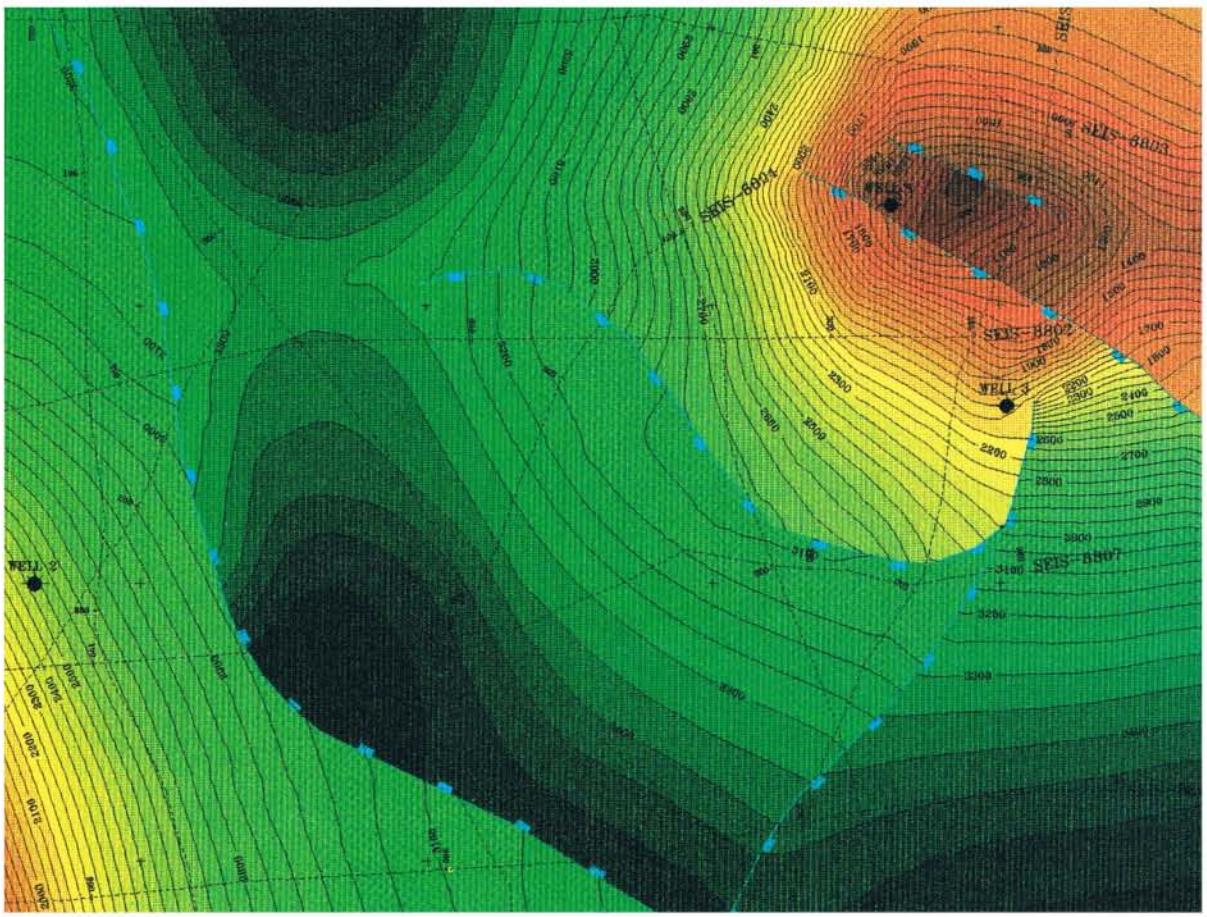


Fig. 3: Time contour map of a horizon derived from interpreted stacked seismic data

Fig. 4: Depth contour map of the above horizon after 3D map migration (SATTLEGGER's SUSI program package)



Horizon Migration / Modeling (HMIG 99) integrated in COMSEIS® via an interface

2D Migration and Modeling (HMIG 99)

The 2D migration and modeling software (HMIG 99) from SATTLEGGER is integrated into the COMSEIS® system via an interface and consequently all the functions of HMIG 99 are available to the COMSEIS® user. The two-dimensional discrete event migration and modeling program allows depth conversion, image ray migration, migration and modeling including transformation of non-reflecting interfaces (faults, salt boundaries).
Velocities within formations may vary both laterally and with depth (curved ray path within formations and refraction at boundaries).

Application within COMSEIS® (see Fig. 5)

Once the interpretation of the horizons and faults has been carried out within COMSEIS®, the velocities, which the HMIG 99 program requires for the migration or the modeling, are also subsequently entered within COMSEIS®.

This can be done

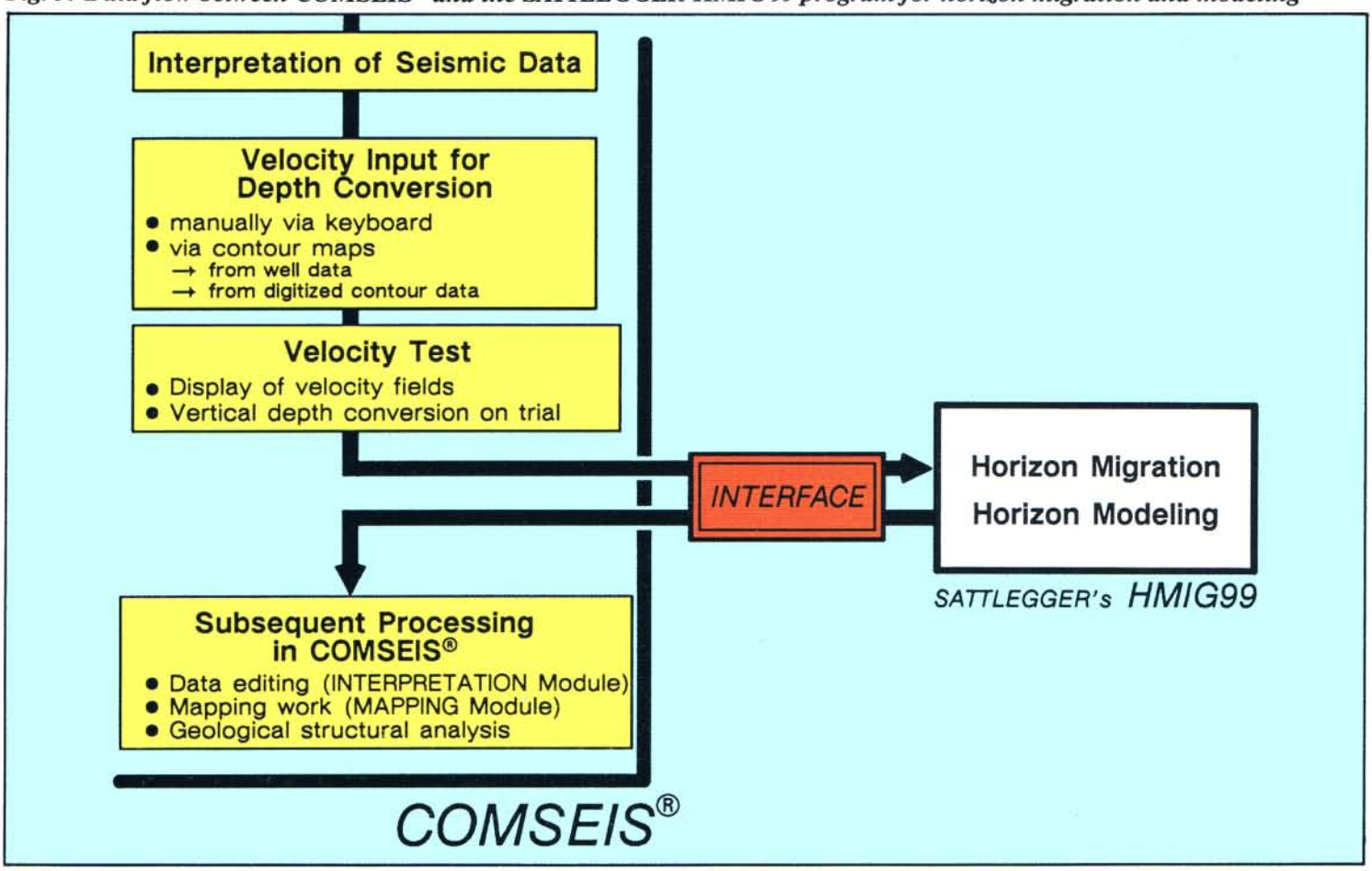
- for each CDP for several horizons
- for each horizon for several CDPs
- via the file of a velocity contour map, the values for specific CDPs being calculated along the seismic line.

It is now possible to check the quality of the input velocities by

- displaying the velocity fields (Fig. 8)
- a vertical depth conversion test

Interpretation and velocity data are then transferred to the HMIG 99 program via an interface. As soon as migration or modeling has been completed the depth or time data are available to the COMSEIS® system. These data can then be edited in the INTERPRETATION module and output in the MAPPING module in the form of a posted map or further processed to create contour maps. Finally, the migrated depth data can form the basis for the geological structural analysis within COMSEIS®.
Figs. 6 and 7 show an interpreted time section of stacked seismic data with a corresponding depth section after horizon migration.

Fig. 5: Data flow between COMSEIS® and the SATTLEGGER HMIG 99 program for horizon migration and modeling



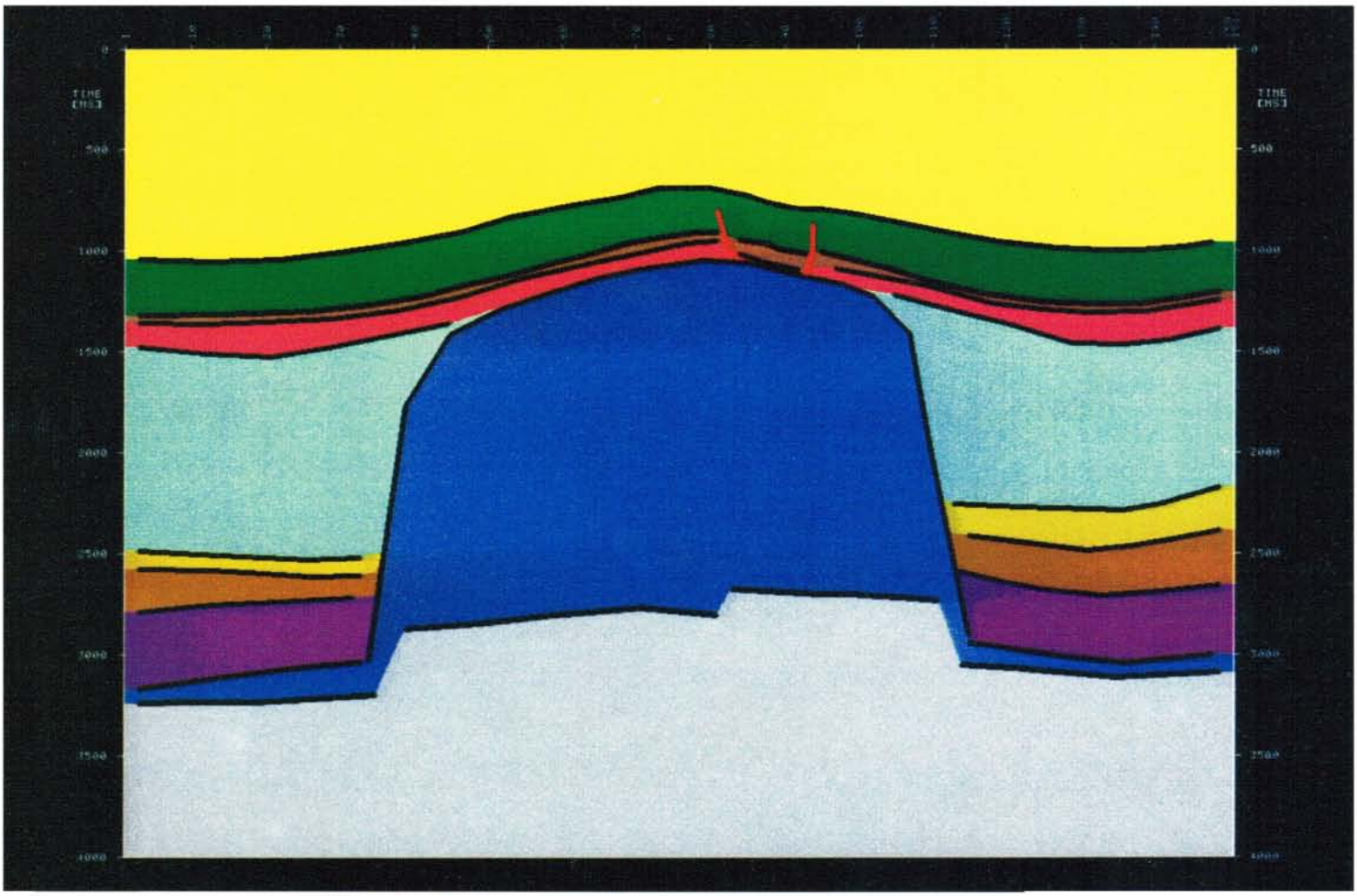
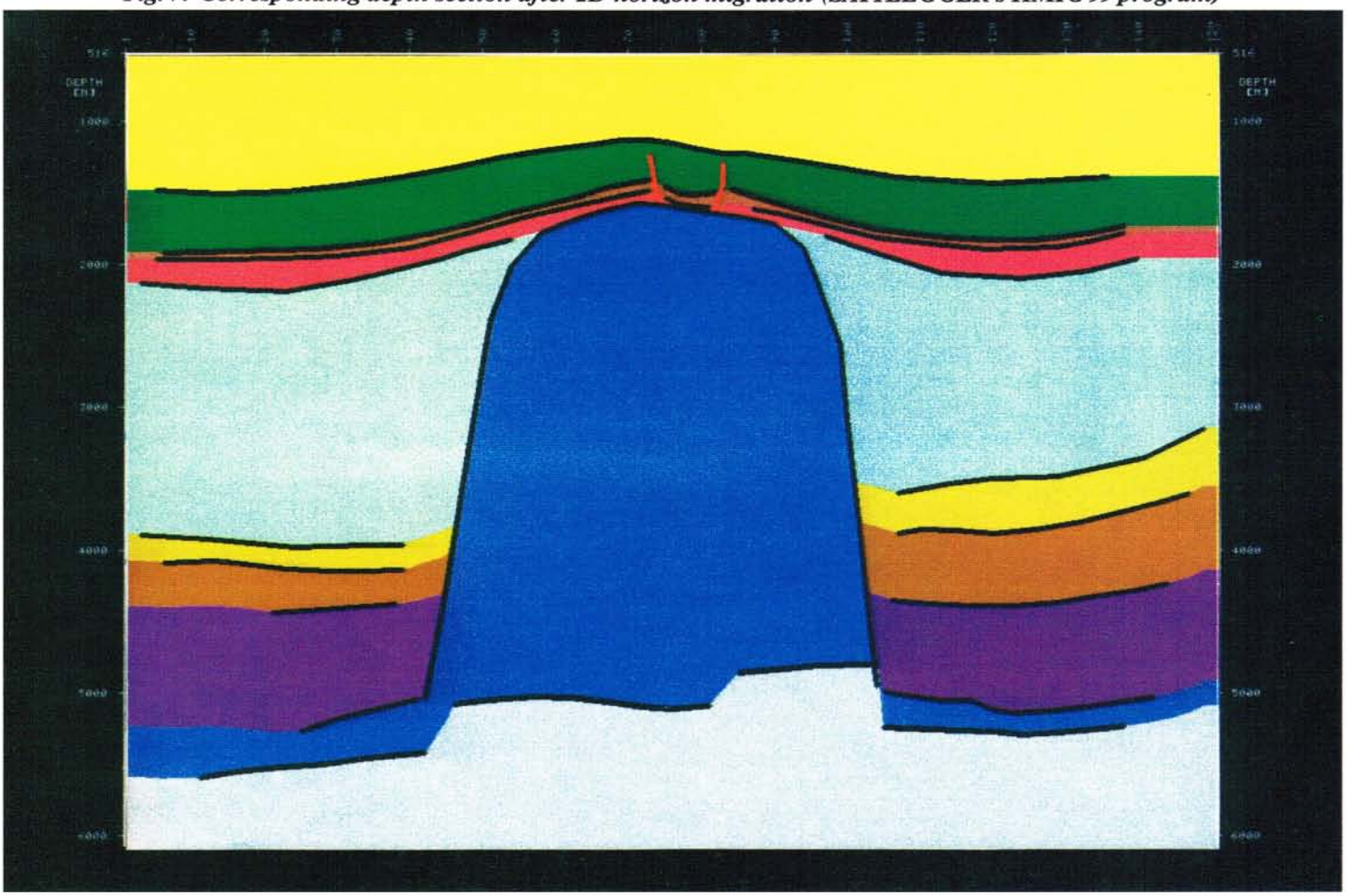


Fig. 6: Time section interpreted from stacked seismic data

Fig. 7: Corresponding depth section after 2D horizon migration (SATTLEGGER's HMIG 99 program)



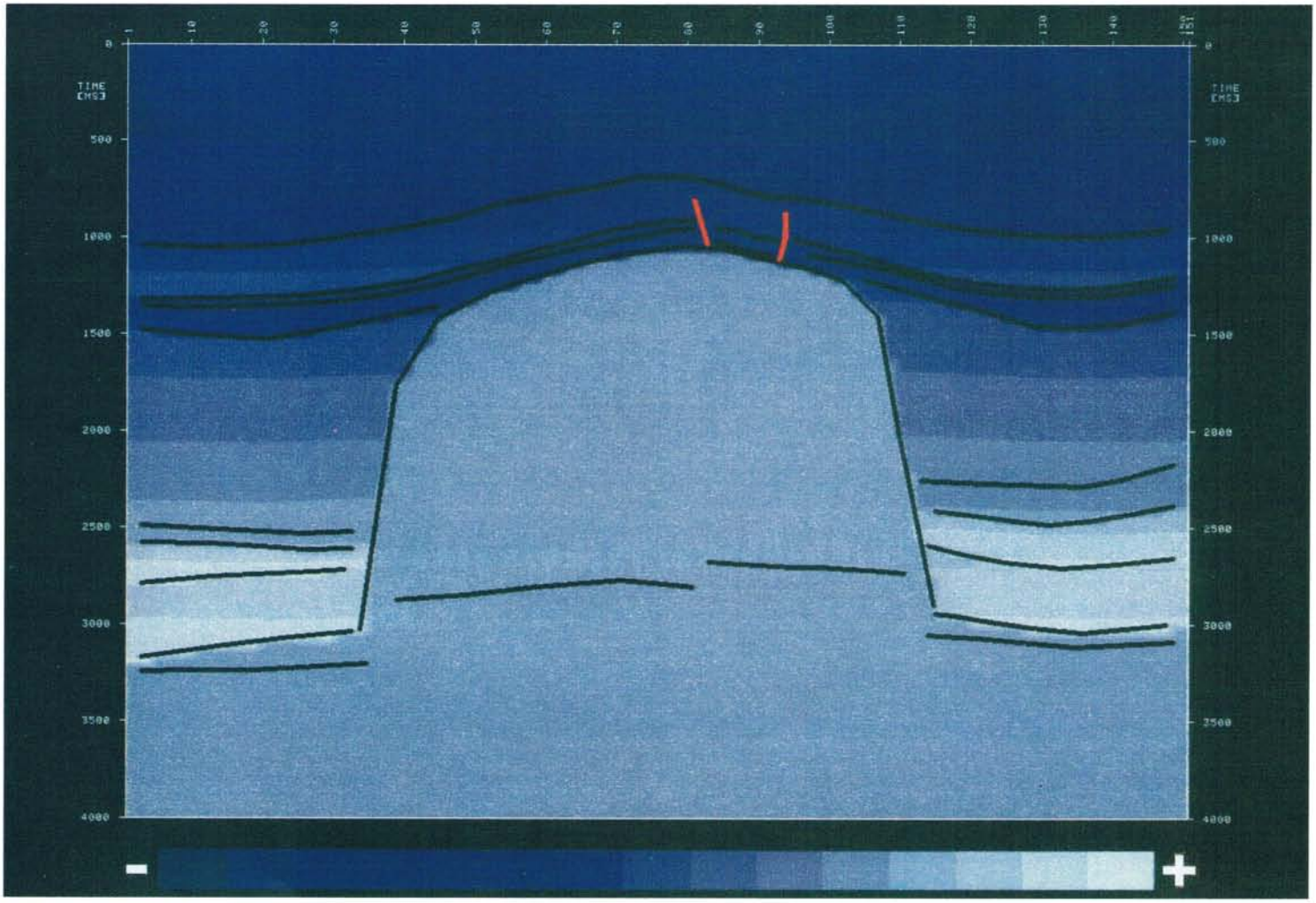
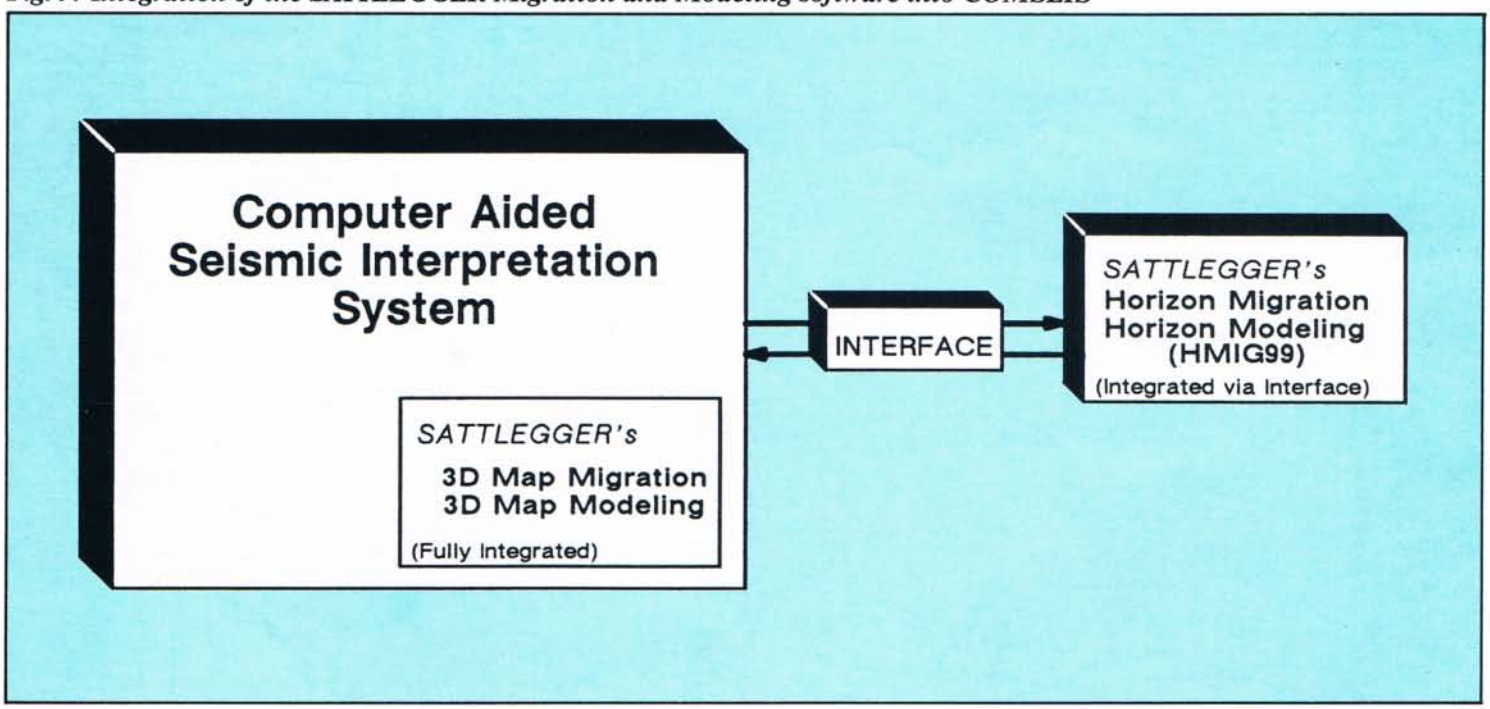


Fig. 8: Velocity field display of an interpreted seismic time section

Fig. 9: Integration of the SATTLEGGER Migration and Modeling software into COMSEIS®



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