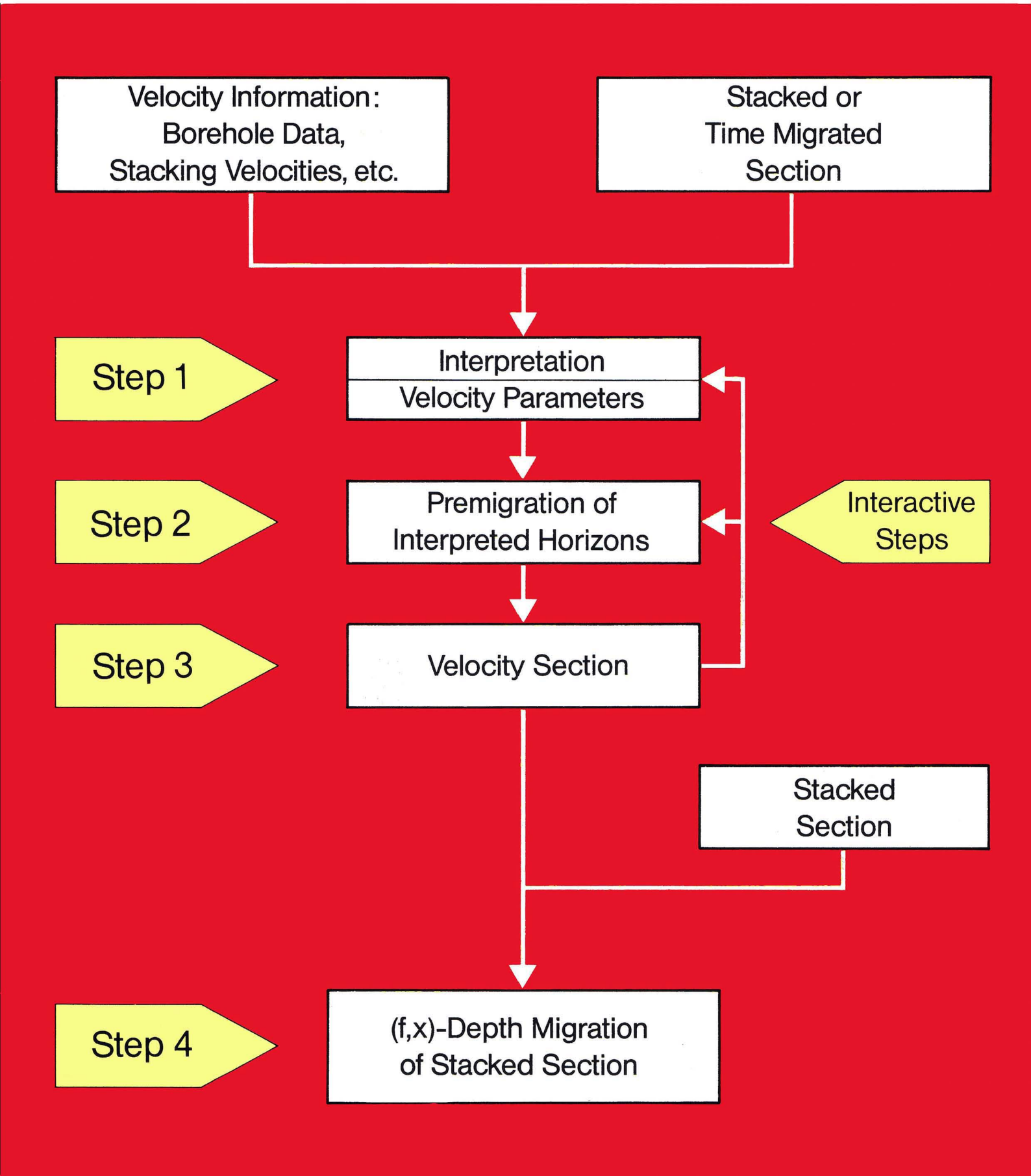
PRAKLA-SEISMOS INFORMATION No. 51

Depth Migration



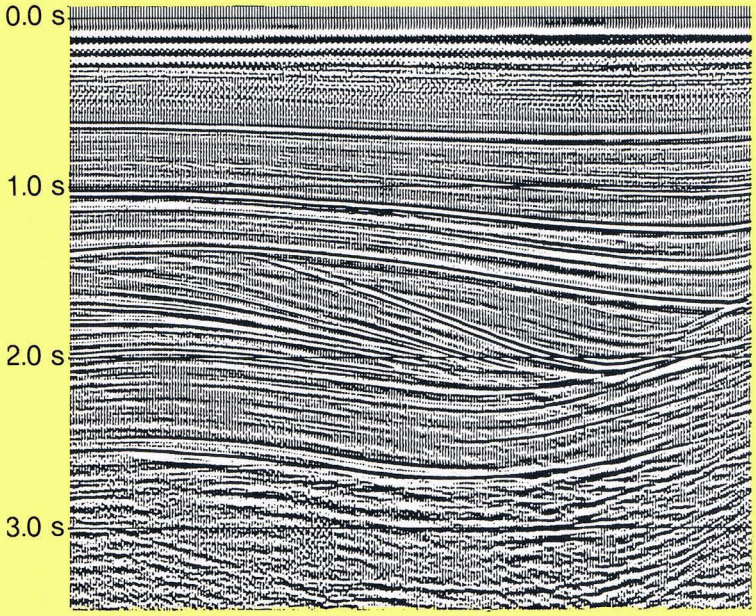


Fig. 1: Stacked section

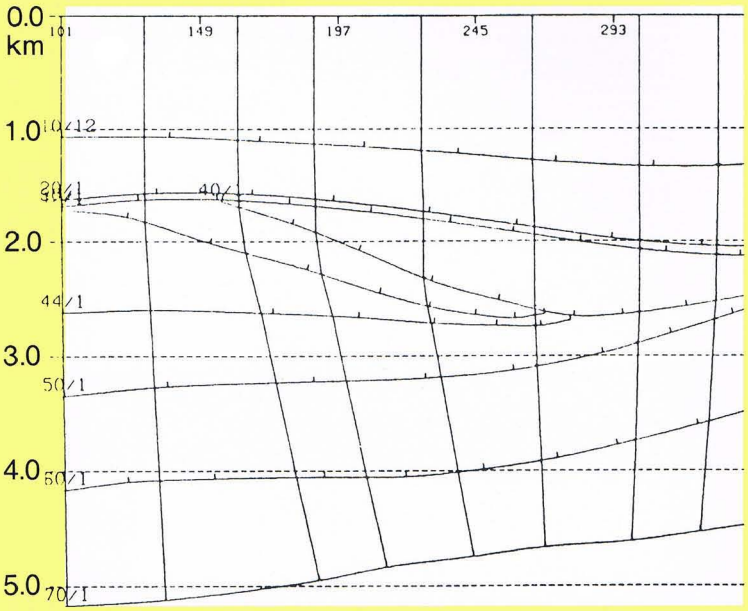


Fig. 2: Horizon migration

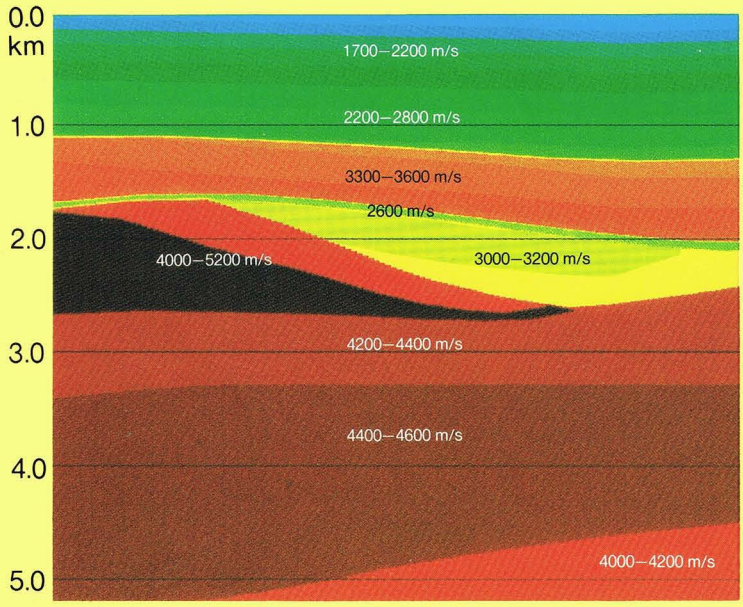


Fig. 3: Velocity section

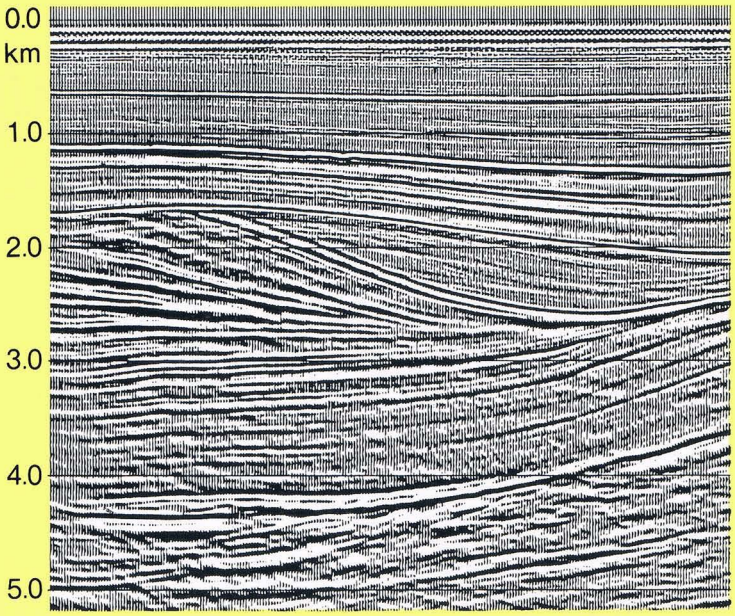


Fig. 4: Depth migration

In time migrations, regardless of whether carried out using the summation or wave equation method, drastic positional errors can occur. These are dependent on the refraction and the depth difference between the refracting and the reflecting horizon. The amount of refraction, in turn, depends on the velocity contrast at the refracting layer boundary as well as on the angle of incidence of the ray and consequently on the difference in dip of adjacent horizons.

Contrary to time migration, **depth migration** takes the effect of refraction into account.

The different termination points of the presaliferous layers in the sections on the back cover clearly demonstrate the positional problems which cannot be solved by simple depth conversion.

Velocity Section, an Intermediate Step for Depth Migration

In order to perform depth migration it is necessary to know not only the velocity parameters but also the location of the velocity horizons. It is therefore recommended to compute the depth migration using a velocity section which is obtained from a horizon-by-horizon migration applying a ray method. As shown in the **flow diagram** on the front cover, the various operations can be divided into four steps:

Step 1:

Digitization of the interpreted stacked (or time migrated) section and determination of the velocity model parameters

Step 2:

Pre-migration of interpreted horizons

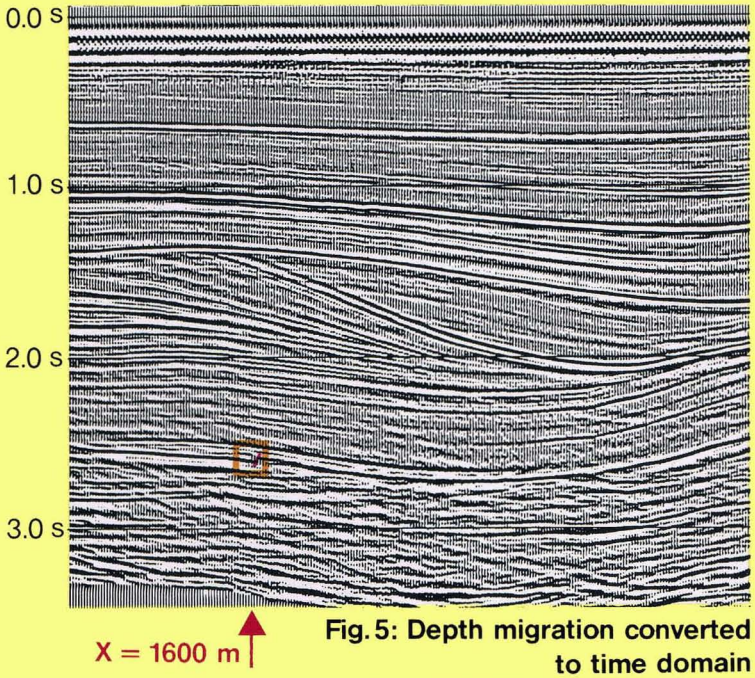


Fig. 5: Depth migration converted to time domain

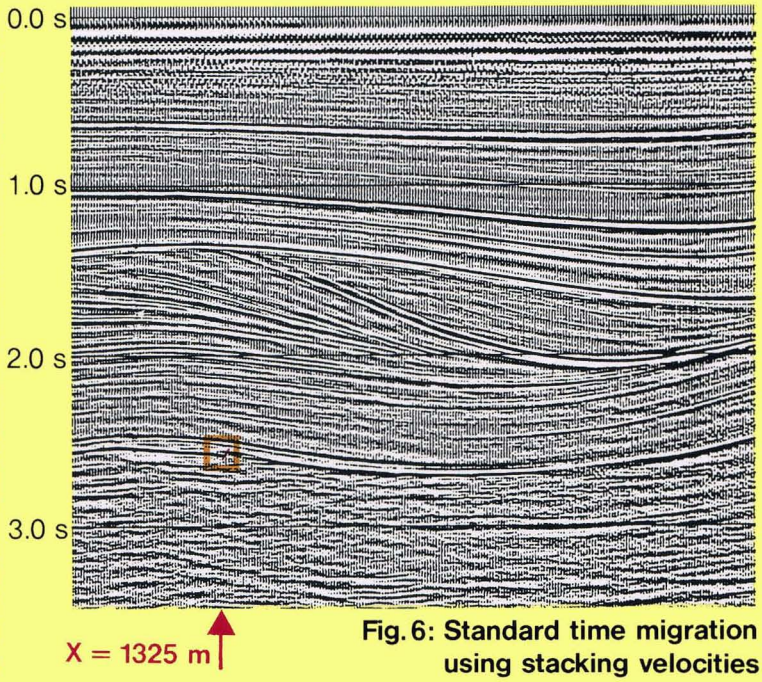


Fig. 6: Standard time migration using stacking velocities

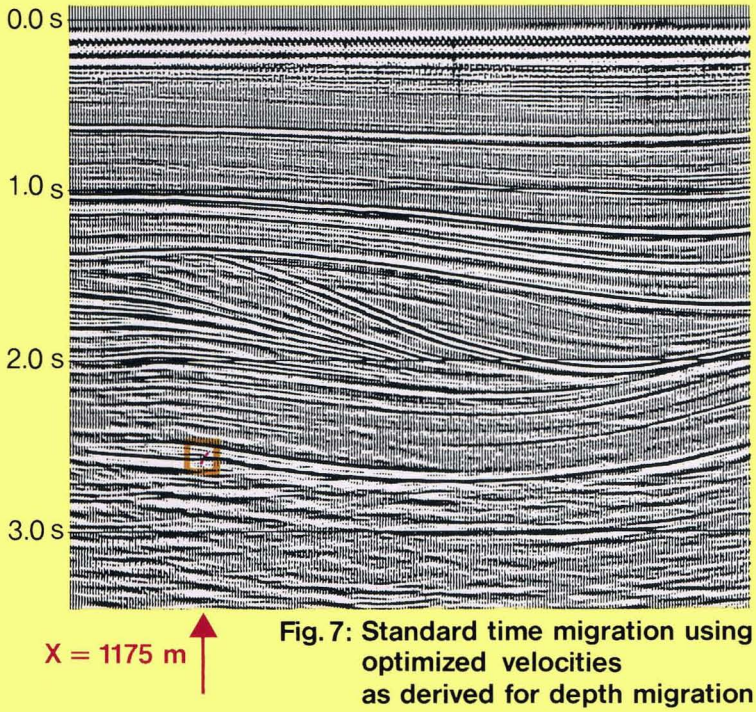


Fig. 7: Standard time migration using optimized velocities as derived for depth migration

The comparison of above sections reveals for a fault indication around 2.7 sec a total migration error of −275 m (compare Figs. 5 and 6). An error of −425 m is due to refraction only (compare Figs. 5 and 7) which in this case is partially compensated for an error of +150 m due to velocities (compare Figs. 6 and 7).

Step 3:

Determination of the velocity section

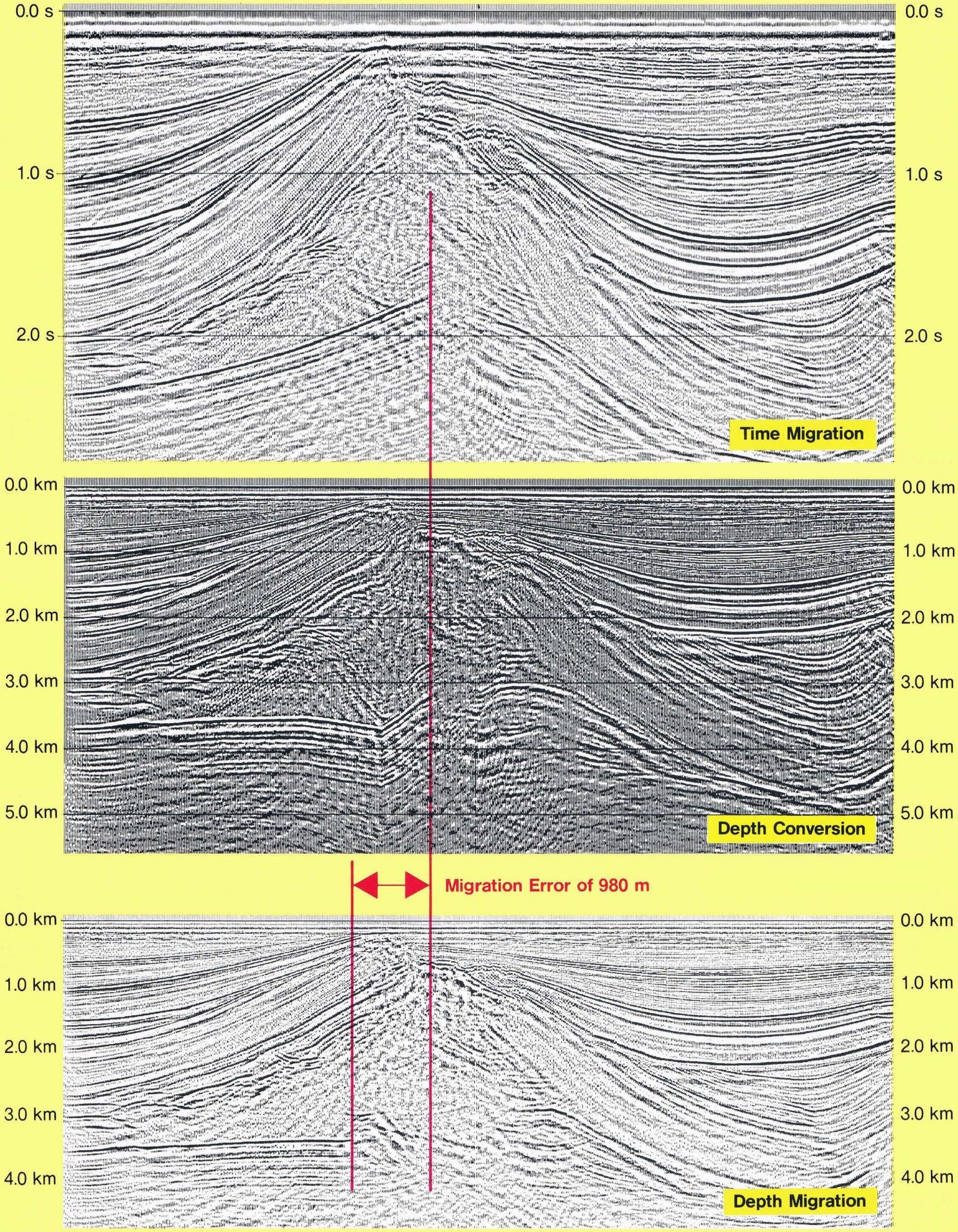
Step 4:

The velocity section is used to migrate the stacked section to the depth domain.

A **stacked section** normally does not allow the estimation of the extent of position error to be expected from the standard time migration (Fig. 1).

The **velocity section** in Fig. 3 derived from the **horizon migration** applying the zero-offset or image ray technique (Fig. 2) points to possible migration errors resulting from lateral velocity variations between 1.5 and 2.0 s : the clear discordance of refracting interfaces between the low velocity trough and the high velocity layers against the reflecting horizons in the deeper part of the above section indicates the occurence of migration errors.

The properly derived velocity section and the exact consideration of the refraction of seismic rays enable the most precise evaluation of seismic depth sections by **depth migration** (Fig. 4).



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