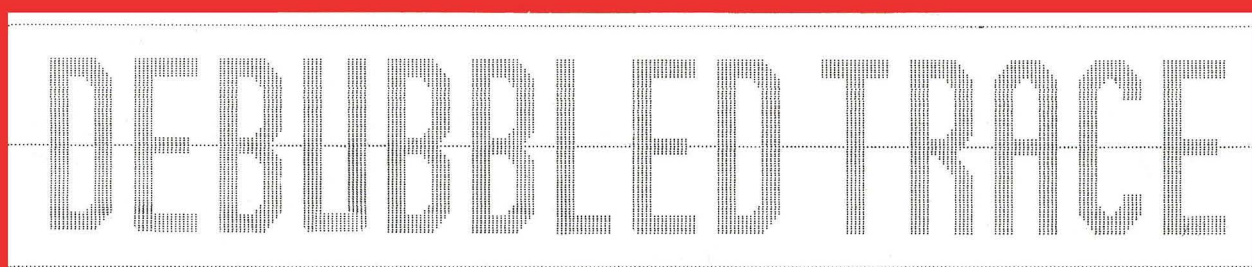
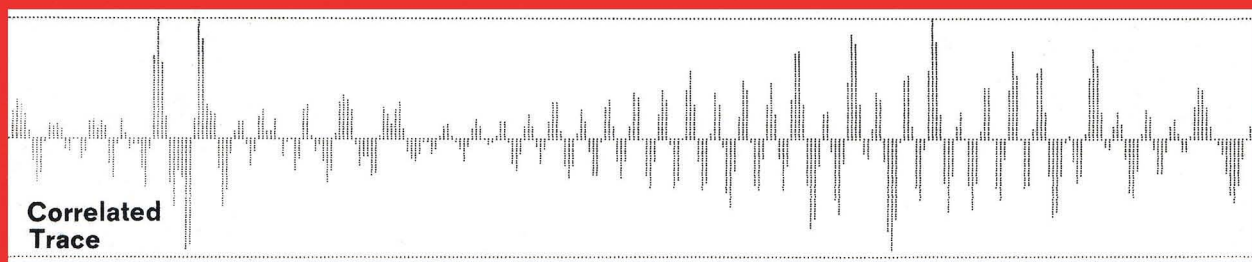
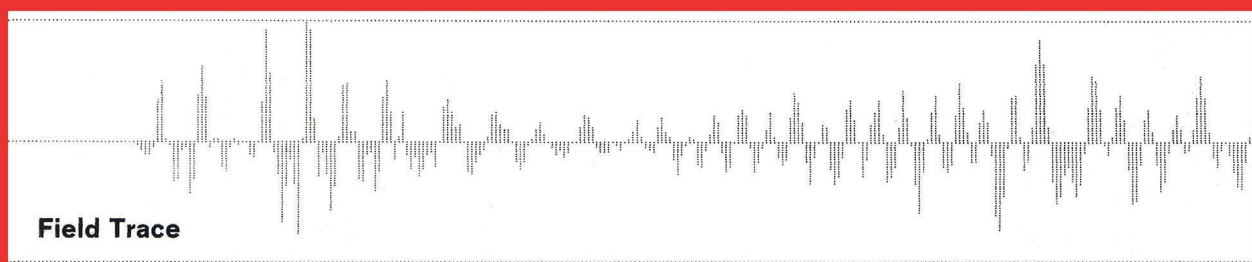




## TSR-Debubbling Technique





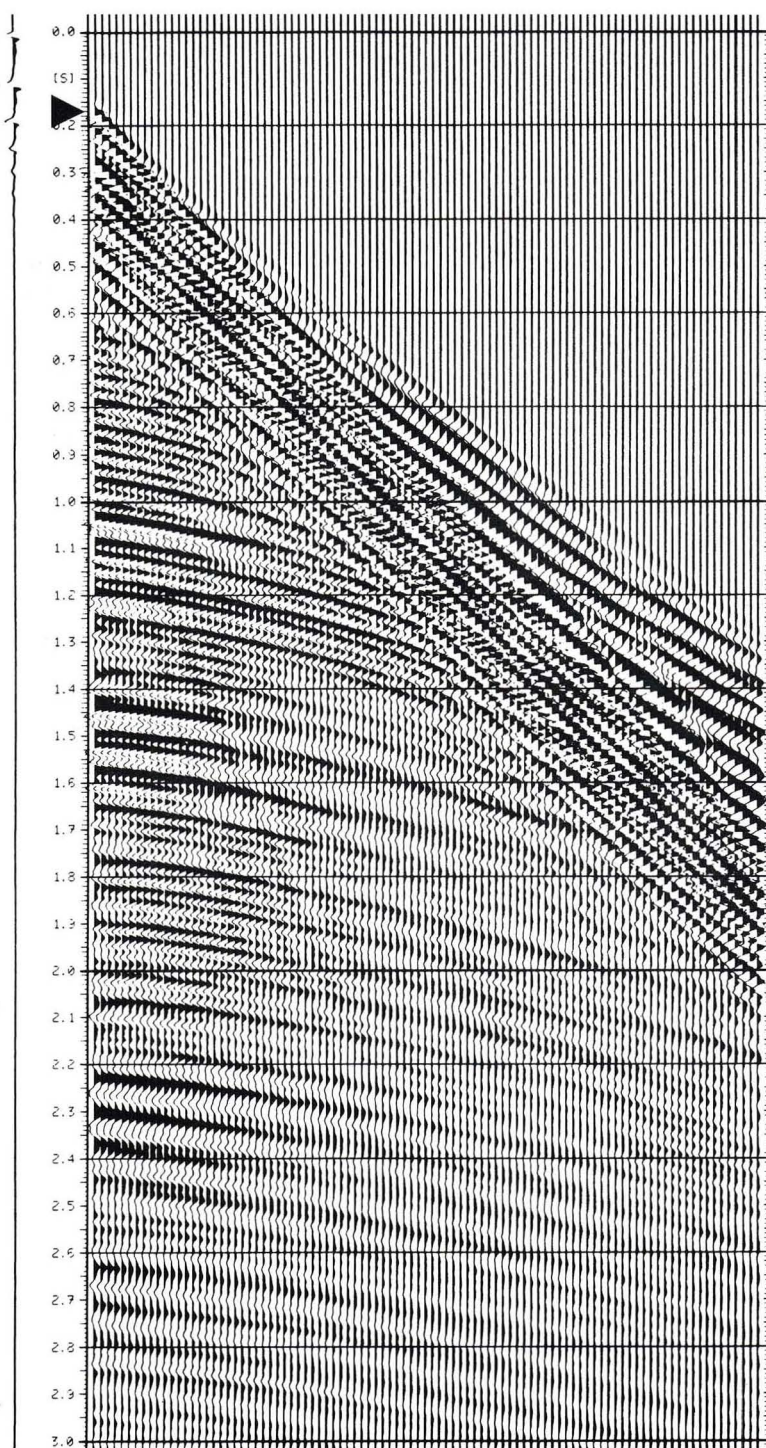
# TSR-Debubbling Technique

Recent debubbling technique consists of two steps

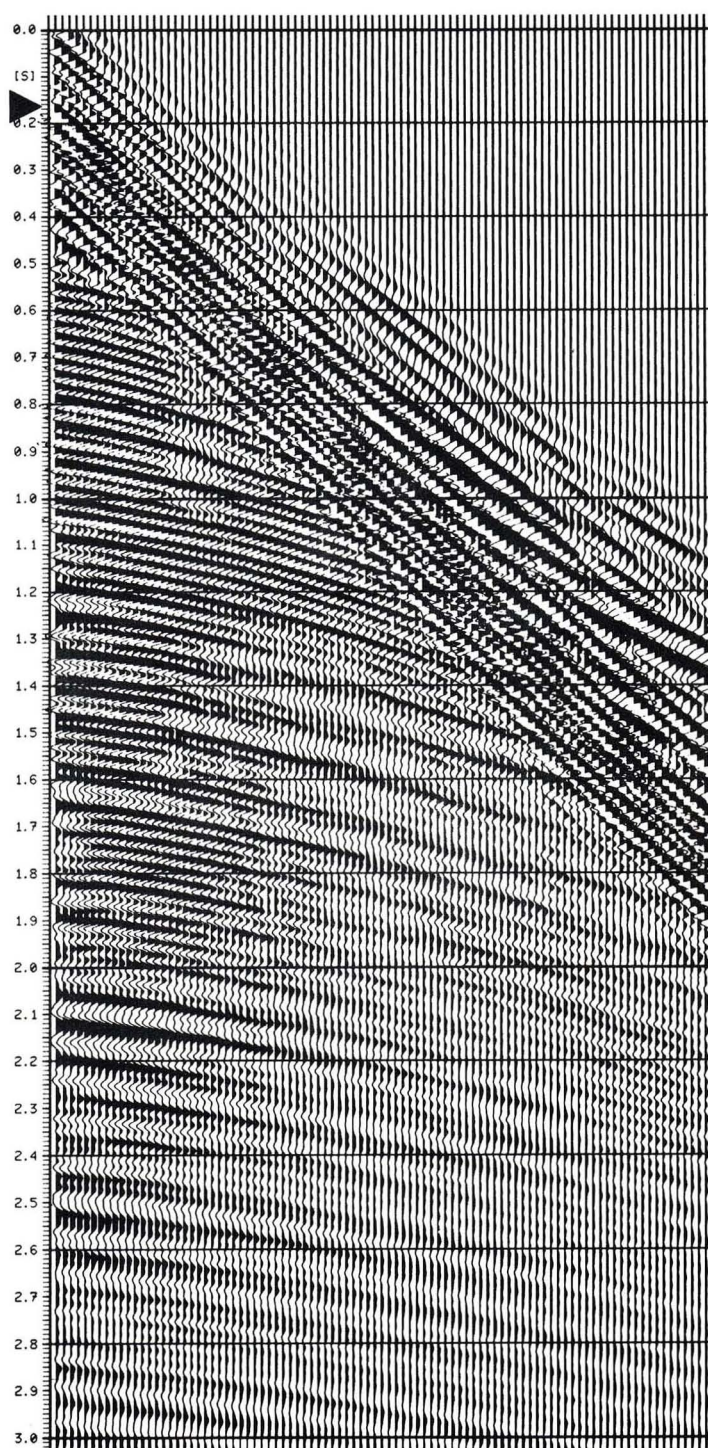
- Correlation
- Application of two-sided Wiener-filter for suppression of correlation noise

Figs. 1 and 2 show a field seismogram, including the appropriate bubble, and the corresponding correlated seismogram. In fig. 1 the signals are lengthened (especially the first arrivals, marked with an arrow, with a tail of almost 500 ms), whereas after correlation they are compressed (first arrivals — after the arrow — only 300 ms); on the other hand, however, correlation noise is generated, which is most easily observed before the first arrivals in a range of approx. 300 ms.

**Fig. 1**  
**Field Seismogram**



**Fig. 2**  
**Correlated Seismogram**





The relationship between correlated trace generated, by means of the bubble trace, and field trace can be clearly seen on the title page.

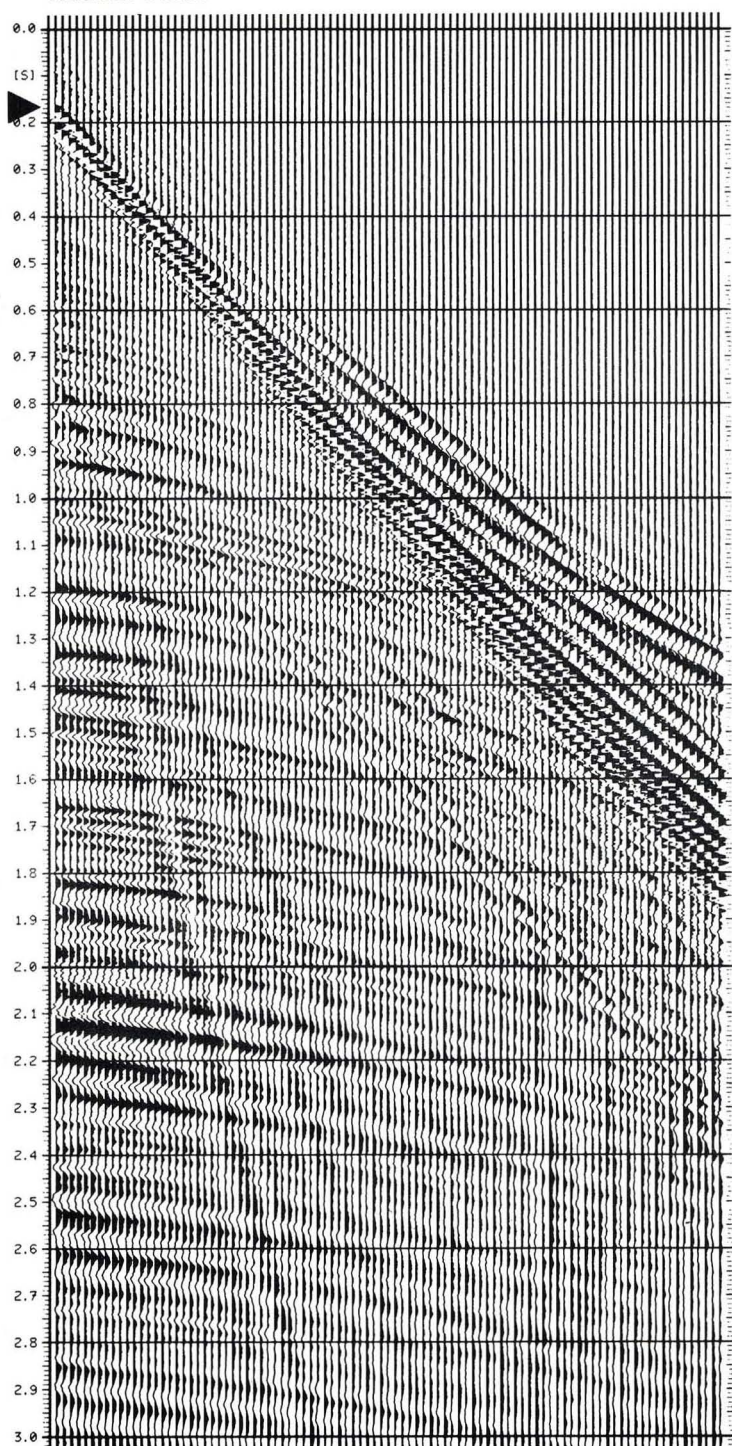
The suppression of correlation noise is generally achieved by applying a two-sided Wiener-filter; the corresponding debubbled seismogram can be seen in fig. 3. However, by side-lobe effects of the Wiener-filter also debubble-noise was generated, which is distinctive at 600/700 ms after the first arrivals.

PRAKLA-SEISMOS has introduced a remarkable improvement:

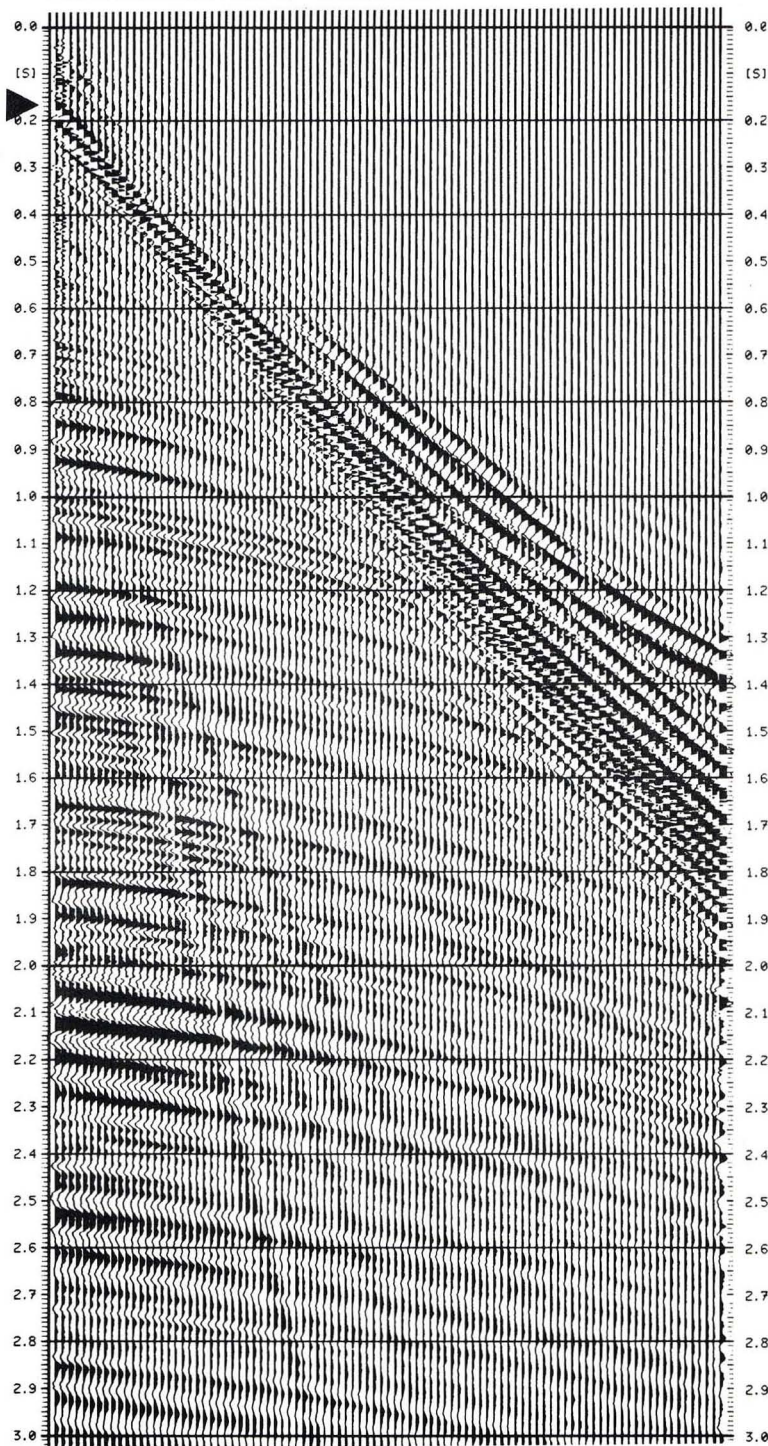
Instead of the Wiener-filter, a two-sided recursive filter (TSR) is used. The generation of noise in this method is much less than in the previous method (see fig. 4).

On the back page of the brochure a part of a section can be seen, left debubbled with Wiener-filter, right debubbled with TSR-technique.

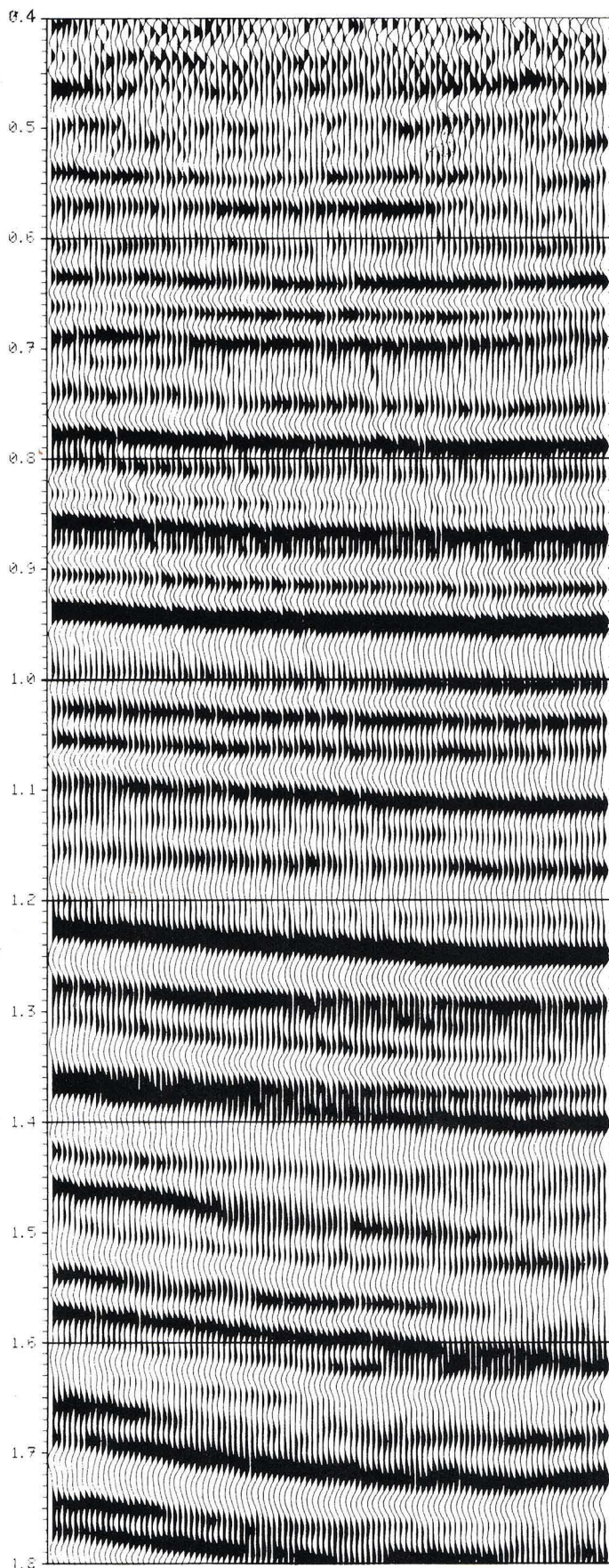
**Fig. 3**  
**Debubbled Seismogram after application of Wiener-Filter**



**Fig. 4**  
**Debubbled Seismogram after application of PRAKLA-SEISMOS' TSR-Filter**

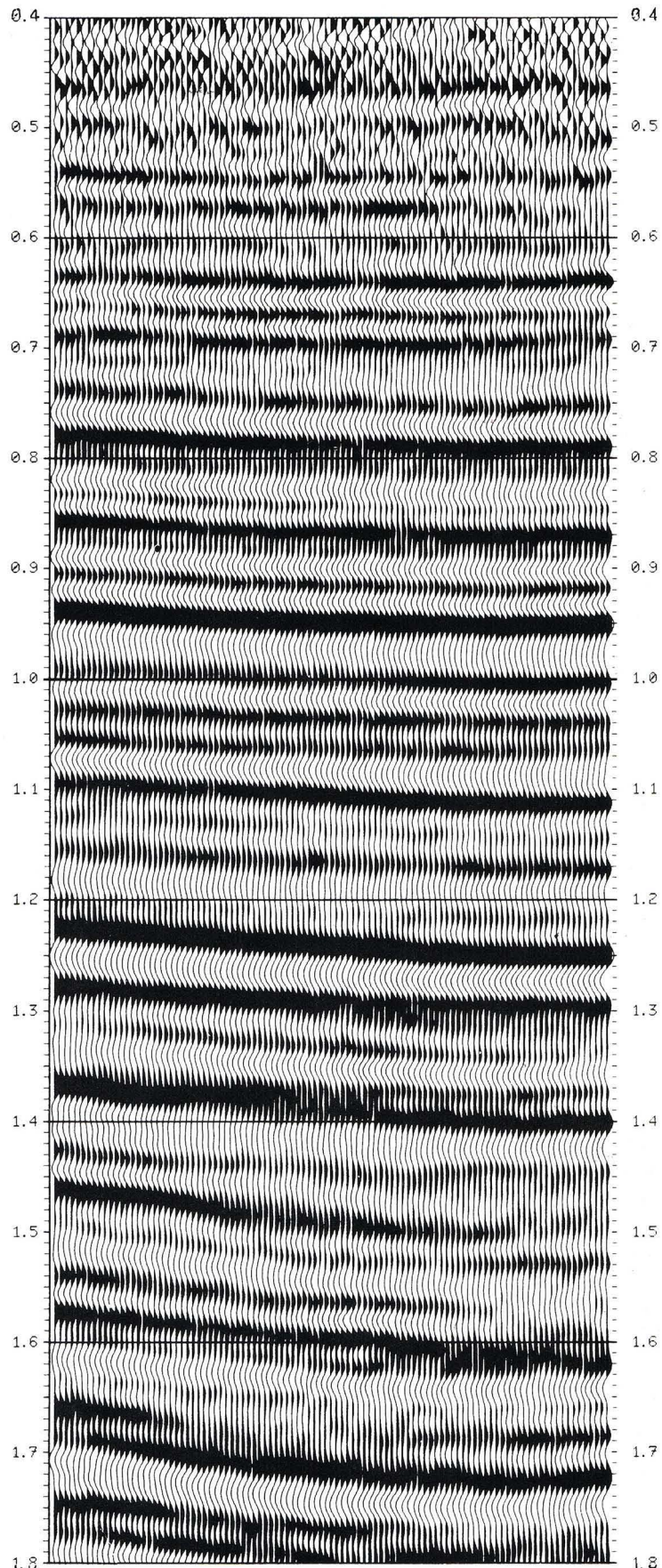






Stacks of debubbled traces, application of

Wiener-Filter



PAKLA-SEISMOS' TSR-Filter



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