Correcting for VVAz prior to AVAz analysis

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1. Introduction:

Roende et al. (2008) computed velocity variation with azimuth using seismic sectoring method for a Fort Worth Basin survey and calibrated their prediction with image logs.

2. Methodology:

Attributes highlight the differences in frequency, time, and amplitude that can effectively isolate areas of more intense fractures (Tod et al., 2007). For moderate offsets, velocity variation with azimuth (VVAz) and amplitude variation with azimuth (AVAz) can be described by an ellipse. AVAz exhibits higher temporal resolution than VVAz. Our goal is to compute a voxel by voxel VVAz analysis to:

1. Condition the data for subsequent AVAz analysis
2. Compare VVAz and AVAz results for accuracy and sensitivity to noise.

3. Workflow:

I propose a workflow of P-wave anisotropy analysis (Figure 1).

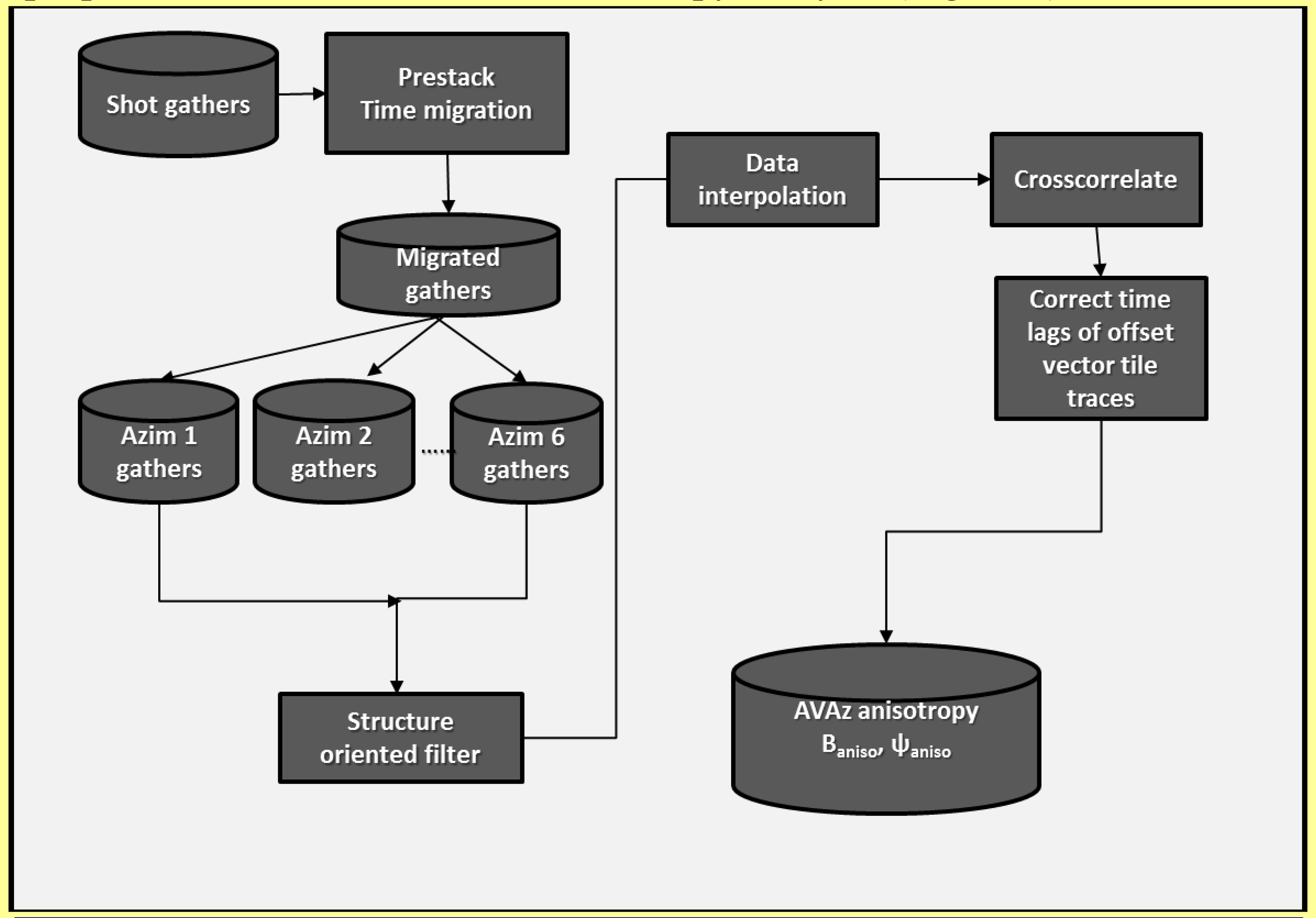

Figure 1: Workflow of alternative P-wave anisotropy analysis.

4. Application

Although the data quality is good, minor improvements through poststack data conditioning can significantly facilitate and improve subsequent interpretation. We applied a similar data conditioning workflow to the azimuthal limited migrated volumes.

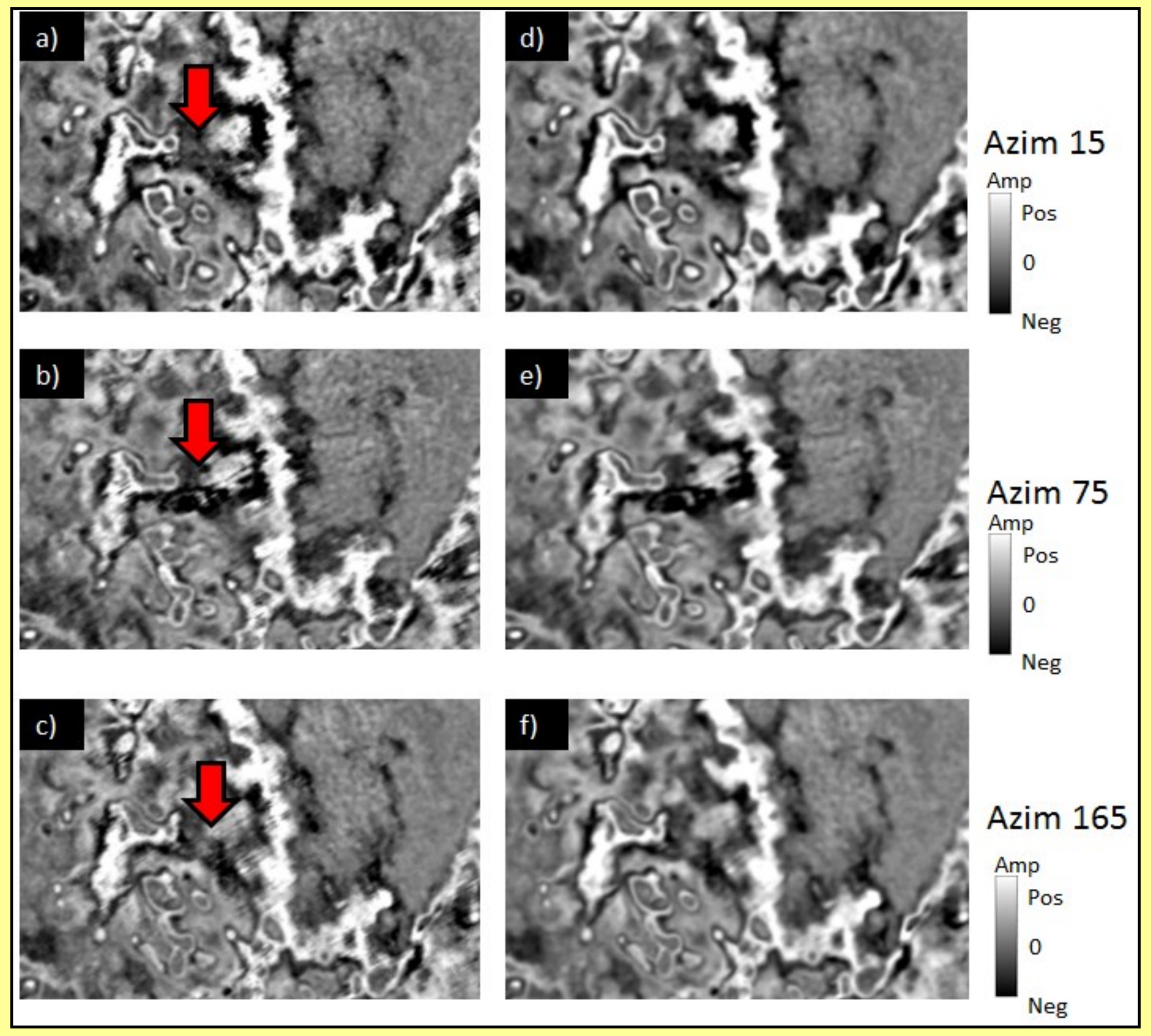

Figure 2. Time slices through a), b), and c) original seismic amplitude; and d), e), and f) seismic amplitude after structural oriented mean-filter. Note that signal-to-noise ratio has improved.

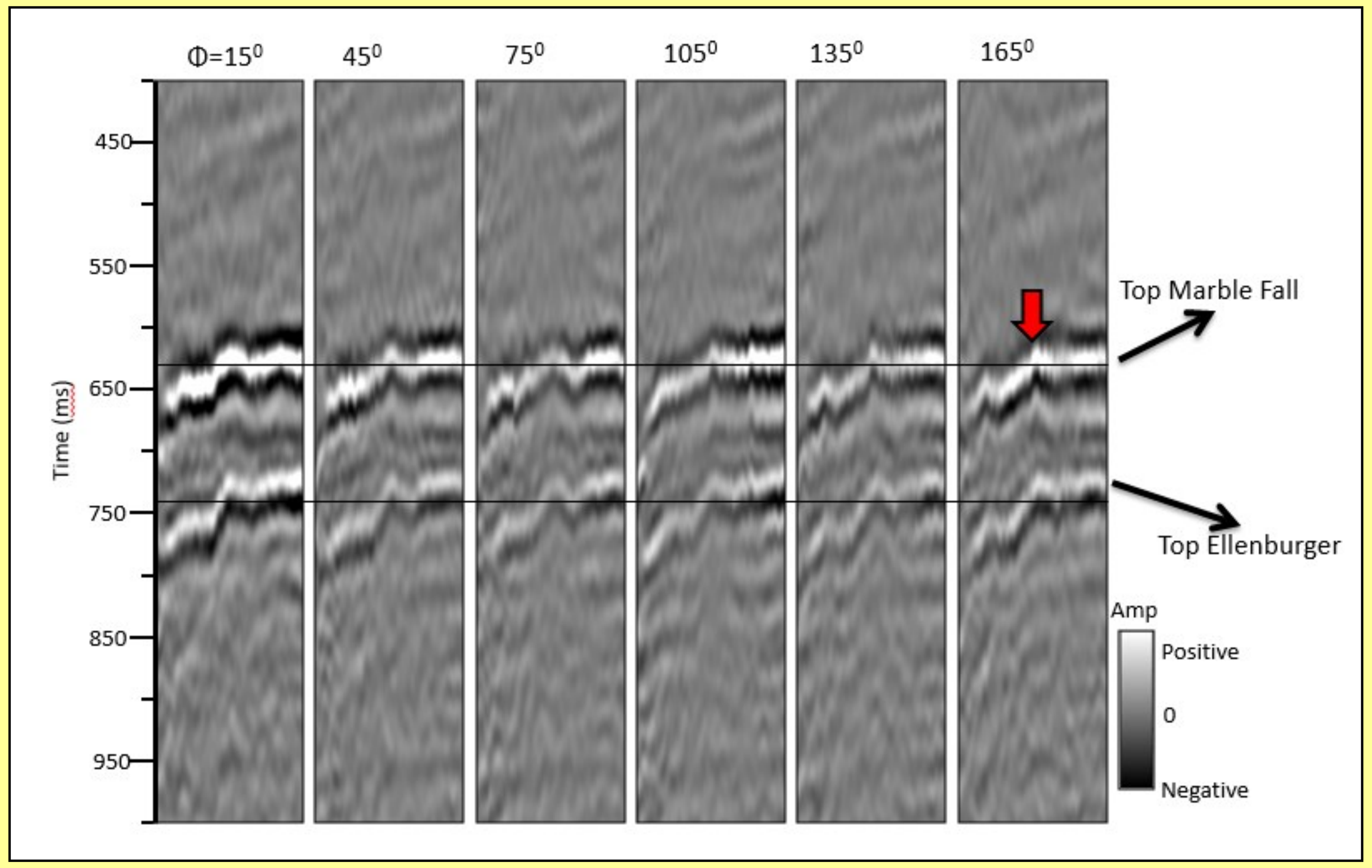

Figure 3. Vertical section with seismic amplitude from different azimuthally migrated volumes. Note that the time and amplitude of specific reflectors varied with azimuth.

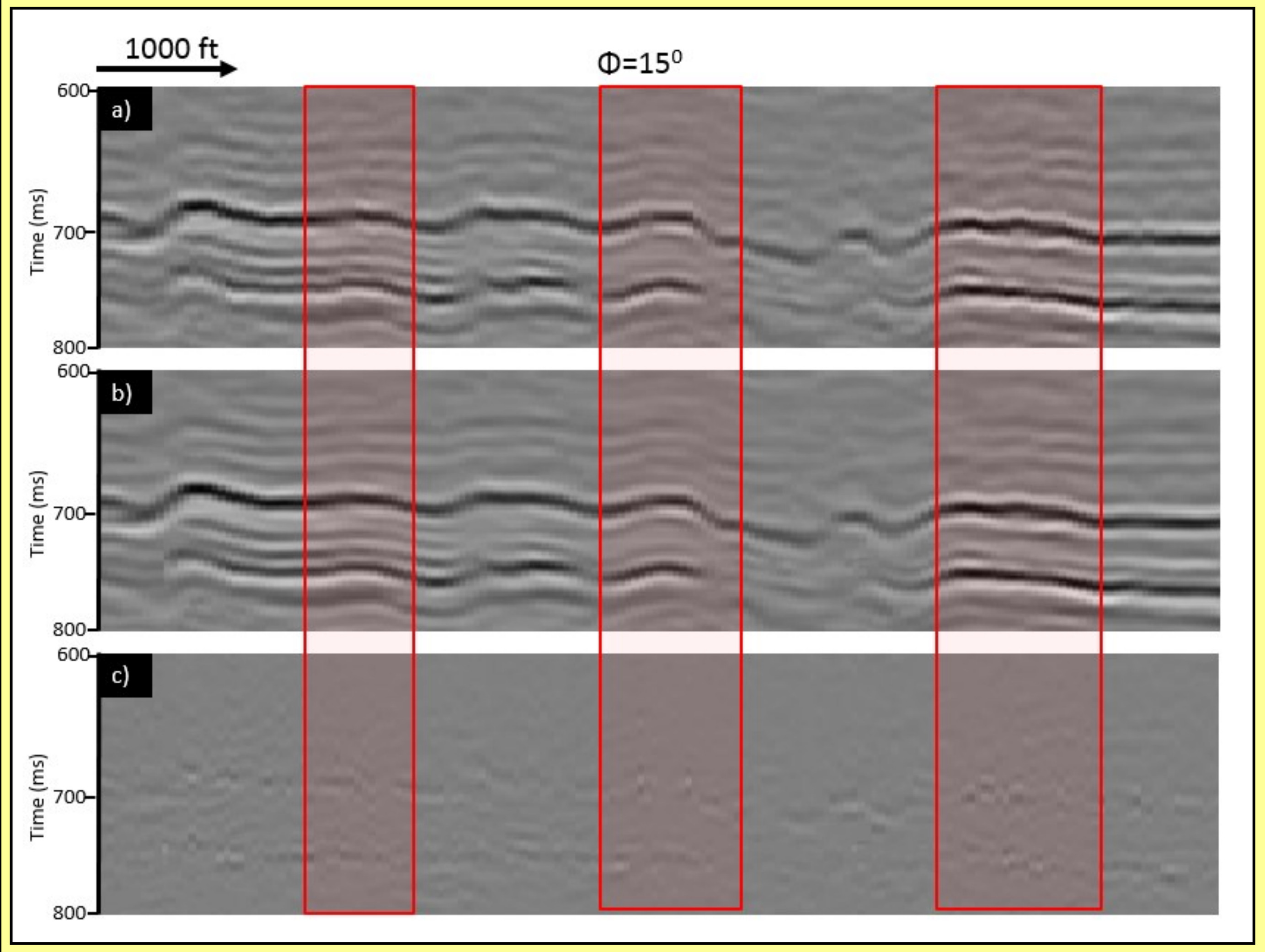

Figure 4. Vertical section with seismic amplitude sector at azimuth = 15° (a) before and (b) after data alignment, and (c) the residual moveout anomalies.

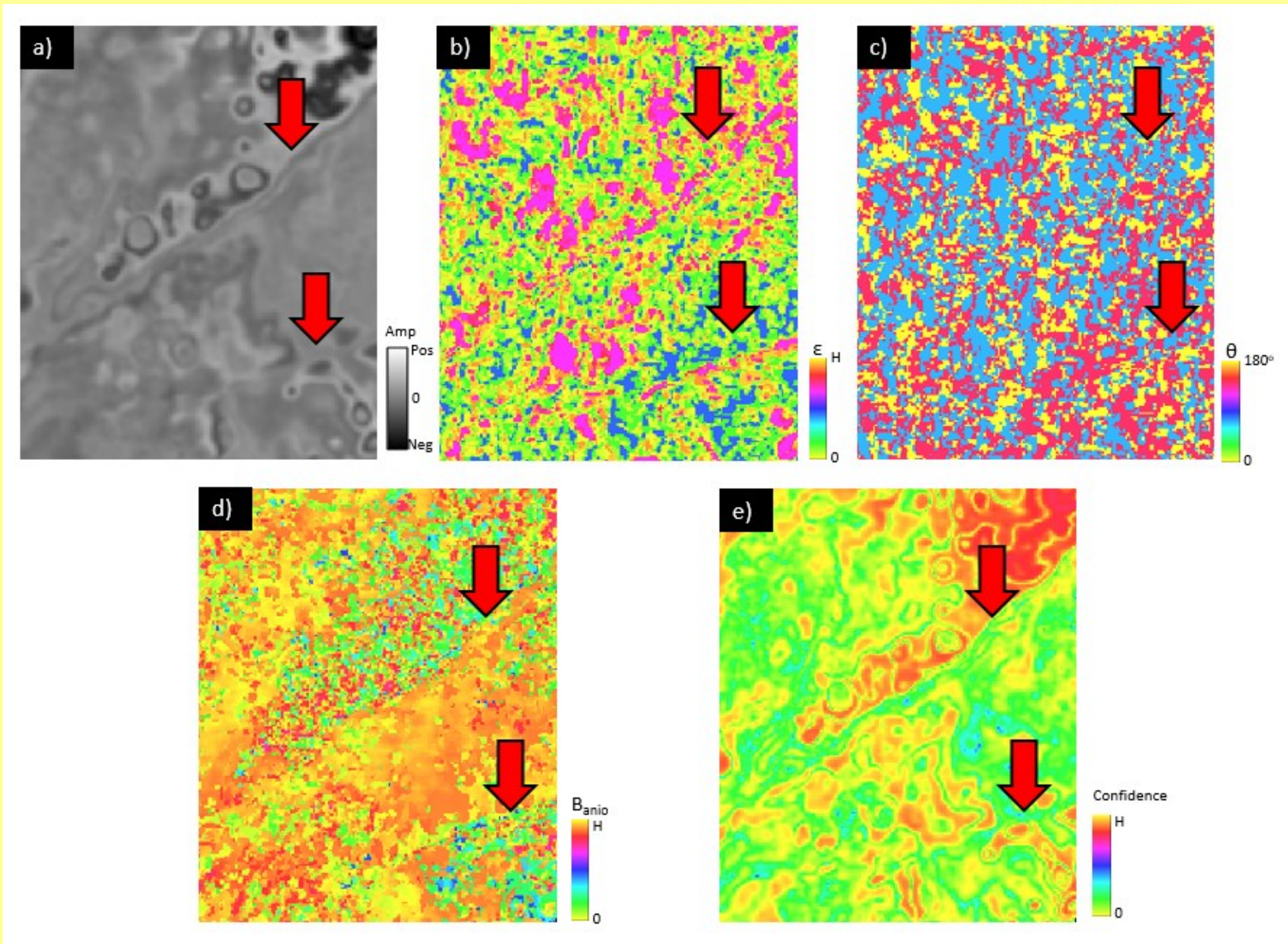

Figure 5. Time slices at t=750 ms through (a) seismic amplitude, (b) VVAz intensity, (c) VVAz max azimuth orientation, (d) AVAz intensity, and (e) anisotropic confidence.

5. Conclusion:

The registration corrections can be used to compute VVAz attributes. The VVAz can then be used to flatten the gathers for subsequent AVAz analysis. The cross correlation method provides a measure of anisotropy that is similar to VVAz but does not require hand picking and the use of Dix's equation. The vertical resolution of crosscorrelation-based VVAz is less than AVAz, but greater than velocity pick-based VVAz.

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