CLAIMS

1. A method, comprising:

conducting a seismic survey, wherein at least one source is used to inject acoustic signals into a subsurface and at least one receiver is used to record the acoustic signals reflecting from subsurface features;

obtaining a velocity model generated by an acoustic full wavefield inversion process;

generating, with a computer, a variable Q model by applying pseudo-Q migration on processed seismic data of the subsurface region, wherein the velocity model is used as a guided constraint in the pseudo-Q migration; and

generating, with a computer, a final subsurface velocity model that recovers amplitude attenuation caused by gas anomalies in the subsurface region by performing a visco-acoustic full wavefield inversion process, wherein the variable Q model is fixed in the visco-acoustic full wavefield inversion process.

2. The method of claim 1, further comprising generating a subsurface image based on the final subsurface velocity model.

3. The method of any preceding claim, further comprising: generating the processed seismic data, wherein the generating includes applying an acoustic ray-based pre-stack depth migration to the velocity model and outputting common image gathers.

4. The method of claim 3, wherein the generating the variable Q model includes flattening the common image gathers in accordance with the guided constraint.

5. The method of claim 3, wherein the guided constraint defines a zone, within the velocity model, that contains a gas anomaly.

6. The method of claim 5, wherein the pseudo Q migration is only applied to the zone that contains the gas anomaly.

7. The method of any preceding claim, wherein the variable Q model is kept fixed through an entirety of the visco-acoustic full wavefield inversion process.

8. The method of any preceding claim, wherein the generating the final subsurface velocity model includes applying pseudo-Q migration to construct another variable Q model via flattening visco-acoustic common image gathers, and the velocity model generated from the visco-acoustic full wavefield inversion process is used as a guided constraint in the pseudo-Q migration.

9. The method of any preceding claim, further comprising iterative repeating, until a predetermined stopping condition is reached, performance of the visco-acoustic full wavefield inversion process, then generation of visco-acoustic common image gathers from visco-acoustic ray-based pre-stack depth migration, and then generation of another variable Q model via flattening the visco-acoustic common image gathers, wherein the velocity model generated from the visco-acoustic full wavefield inversion process is used as a guided constraint in the pseudo-Q migration.

10. The method of claim 2, further comprising using the final subsurface velocity model and the image of the subsurface to extract hydrocarbons.

11. The method of claim 10, further comprising drilling a well to extract the hydrocarbons, wherein the well is disposed at a location determined by analysis of the subsurface image.

12. The method of any preceding claim, wherein the guided constraint is guided by geological structures inverted from the acoustic full wavefield inversion process.