The following are snippets from the current issue of GEOPHYSICS. I picked them from the papers with a picture or two that are self-explanatory and self-contained for making a point of interest. I would like to invite you to browse through the entire issue to get a full update on the latest developments in exploration geophysics.

One of the three papers mentioned below is on computing reverse-time migration (RTM) angle gathers. The topic is hot—this year's SEG Annual Meeting Technical Program had a full session on RTM angle gathers. With the steady decrease in computing cost, prestack depth imaging has moved from ray-tracing-based Kirchhoff migration to wave-equation-based RTM. Migration-velocity model-building, on the other hand, is slower in catching the wave-equation bandwagon. The current workhorse for migration velocity analysis (MVA) in the seismic imaging industry still relies primarily on reflection ray-tracing tomography which may fail if the Earth model is complex. This is where angle gathers can be handy. For example, in subsalt imaging, if we have a good handle on the velocity above the base of salt, we will only need to trace rays from the subsalt image points up to the base of salt. Subsalt ray tomography can work provided that the subsalt velocity is simple. In this case, the (reflection incident) angle gathers are preferred over the traditional (surface) offset gathers to avoid ray tracing through the complex salt region to the surface. RTM angle gathers are preferred over the Kirchhoff ones because ray-based solutions are not adequate when the wavefields contain significant diffractions and multi-scattering in regions with high-contrast complexities or small inhomogeneities.

Common-image gathers in the incident phase-angle domain from reverse-time migration in 2D elastic VTI media by Qunshan Zhang and George McMechan. The authors continue the study of RTM angle gathers from their previous work with elastic isotropic media. They obtain the reflection incident angle at an image point by computing the source-side incident vector and the reflector-normal vector. This allows the authors to handle both quasi-P-wave reflections and quasi-P-to-S conversions. Because a P-wave polarizes in the direction of propagation, Zhang and McMechan justify using the quasi-P-wave polarization vector for the incident vector. In conventional RTM, the imaging condition calls for cross-correlating the source-side wavefield with the time-reversed receiver-side wavefield and summing over the entire duration of the source time. The authors propose limiting this summation time to a short duration around the time of maximum amplitude in the source-side wavefield for each image point. This strategy reduces the cost of angle-gather computation potentially by two orders of magnitude. Zhang and McMechan test their method for a simple model. Figures 1 and 2 below show that the angle gathers exhibit the correct behavior—"*s*miling" when the velocity is too "*s*low" and "*f*rowning" when the velocity is too "*f*ast."

Magnetic, electrical and GPR waterborne surveys of moraine deposits beneath a lake: A case history from Turin, Italy, by Luigi Sambuelli, Cesare Comina, Sivia Bava, and Claudio Piatti. Sambuelli et al. simultaneously apply three nonseismic methods with different resolution to study the bottom structure of the lake. The GPR survey is used to image the shallow sediments and to define the lake bottom bathymetry for constraining the inversions of the magnetic and electrical data. The deep penetration of the magnetic survey allows authors to define bedrock structures (Figure 3). The high resolution of GPR and continuous vertical electric sounding (CVES) enables the authors to characterize the bedding of fine shallow sediments (Figure 4). By interpreting the images of the anomalies from the three surveys together, the authors are able to recognize gravel-rich underground water passageways and to distinguish the coarse-grained morainic outcrops from the fine grained sediments.

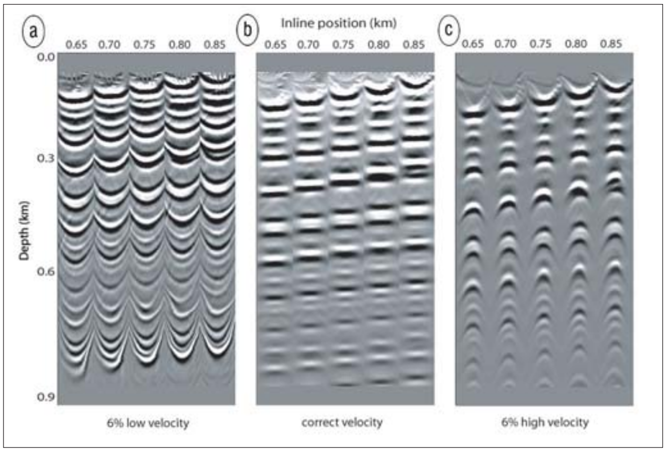

Figure 1*. (Figure 7 of Zhang and McMechan): A few selected qPqP angle-domain CIGs. The phase angle for each CIG spans from −50° (left) to 50° (right). The image gathers (a) curve up if velocity is 6% too slow, (b) are flat if the velocity is correct, and (c) curve down if the velocity is 6% too fast.*

Finite-difference modeling experiments for seismic interferometry by Jan Thorbecke and Deyan Draganov. Seismic interferometry is about generating data with one type of propagation paths using existing data with another type of propagation paths. Thorbecke and Draganov consider the reconstruction of reflection data (with virtual sources on the surface) using passive seismic data with sources randomly distributed in the subsurface (Figure 5). Figure 6 shows the reconstructed reflection response as a reference case. From this reference point, the authors study the effects of noise duration and the distribution of recorded sources on the quality of the reconstruction. Thorbecke and Draganov have included their finite-difference program together with the paper for the Software and Algorithms section in GEOPHYSICS. All figures in the paper can be reproduced with the bundled software (and SU for making the plots).

Following is a list of papers recommended by the Associated Editors (AE) for GEOPHYSICS Bright Spots:

1) *2.5D controlled-source EM modeling with general 3D source geometries* by Rita Streich, Michael Becken, and Oliver Ritter. AE Colin Farquharson's remark: This paper provides an EM numerical modeling technique specifically for the type of complicated, real-life grounded electric line source used for some onshore hydrocarbon exploration and monitoring. The generality of the source that can be dealt with, and the application (hydrocarbon exploration), will make this paper interesting to a significant fraction of the GEOPHYSICS readership.

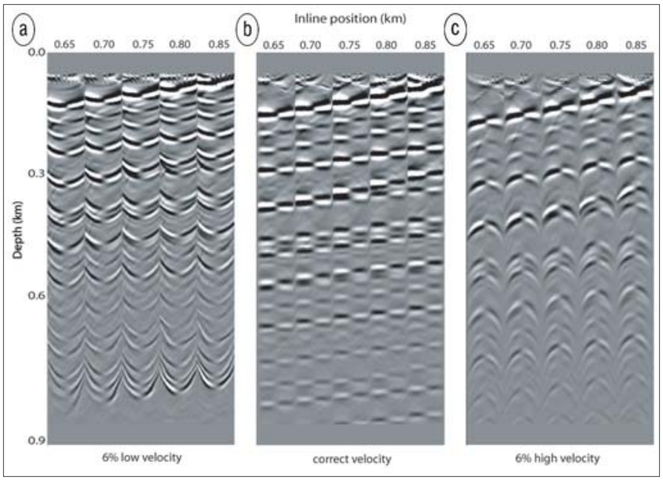

Figure 2. (Figure 8 of Zhang and McMechan): A few selected qPqS converted-wave angle-domain CIGs. The phase angle for each CIG spans from −50° (left) to 50° (right). The image gathers (a) curve up if velocity is 6% too slow, (b) are flat if the velocity is correct, and (c) curve down if the velocity is 6% too fast. All CIGs have a sign change across zero incident angle.

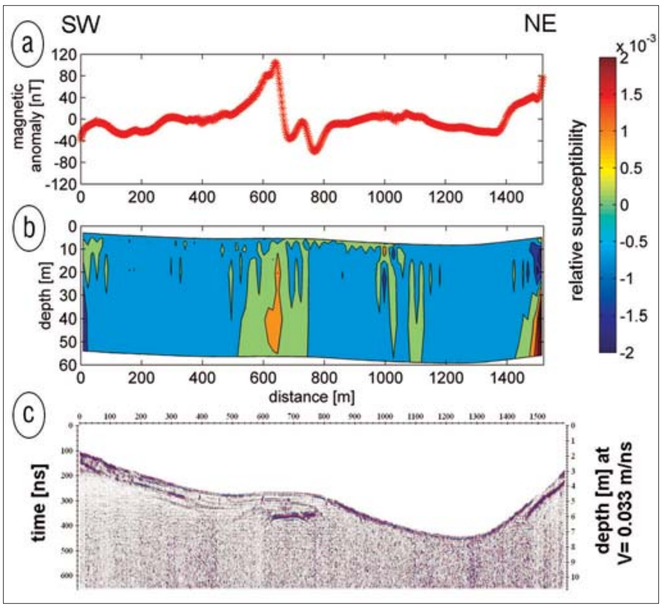

Figure 3. *(Figure 14 of Samuelli et al.): Results of 2D inversion of a magnetic profile, (a) magnetic anomaly and (b) contour map of the relative susceptibility. The corresponding GPR bathymetry profile is shown in (c). Note that the depth scale for the GPR profile spans 10 m, while the depth scale for the magnetic profile spans 60 m. Also note the anomaly between the lateral positions at 500 m and 700 m. The top of the anomaly is highly correlated laterally with a strong reflector in the radargram.*

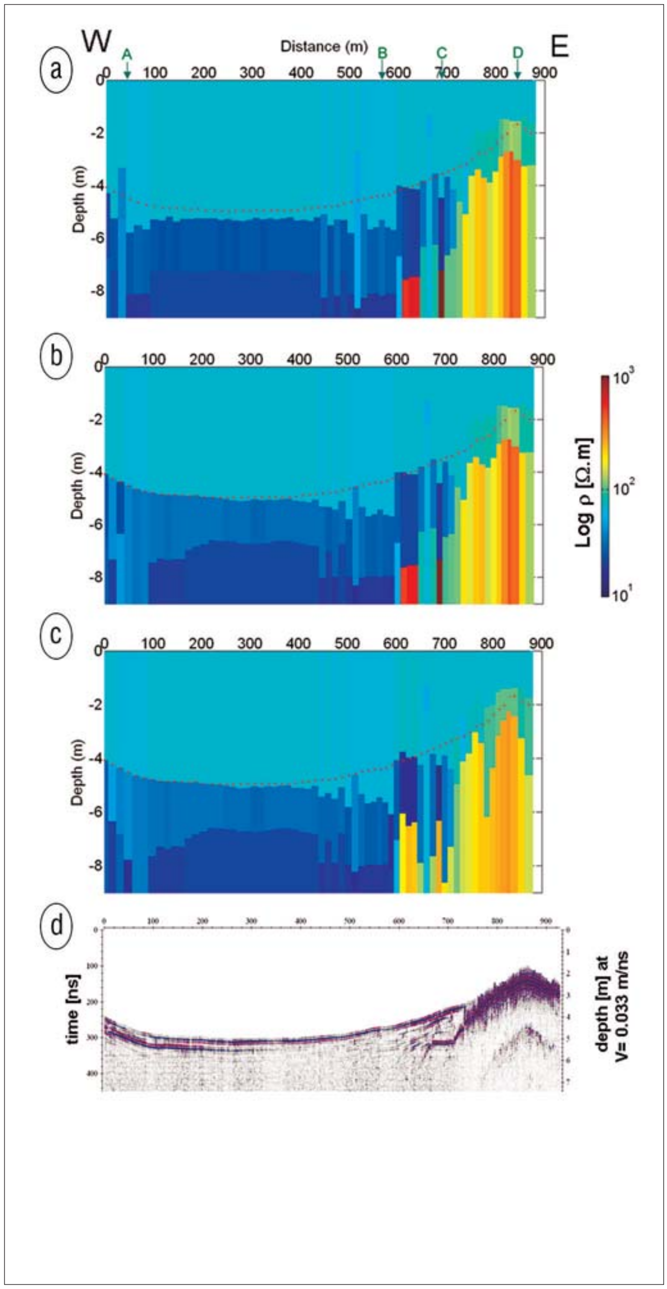

Figure 4. (Figure 16 of Samuelli et al.): Resistivity LCI inversion for an electrical profile: (a) with no constraints, (b) with strong constraint using radar bathymetry, and (c) with strong constraint using radar bathymetry and with moderate lateral constraint on resistivity in the first and third layers. The corresponding GPR profile is show in (d).

2) *Magnetic, electrical and GPR waterborne surveys of moraine deposits beneath a lake: A case history from Turin, Italy* by Luigi Sambuelli, Cesare Comina, Silvia Bava, and Claudio Piatti. AE Randy Keller's remark: Waterborne geophysical surveys in lakes can be used to obtain several independent physical parameters to study the sediments. Sambuelli et al. explored the possibilities of retrieving information about both shallow and deep geological structures beneath a lake by means of waterborne nonseismic methods. They undertook simultaneous magnetic, electrical and GPR waterborne surveys on the Lake Candia in northern Turin, Italy. Waterborne GPR was used to obtain information on the bottom sediment and the bathymetry needed to constrain the magnetic and electrical inversions. They computed 2D constrained magnetic inversions for selected profiles, along with a laterally constrained inversion for one electrical profile. The magnetic survey detected some deep anomalous bodies within the sub-bottom moraine. The electrical profiles gave information on the superficial layer of bottom sediments.

3) *Data-driven, target-oriented, kinematic prediction and subtrac-*

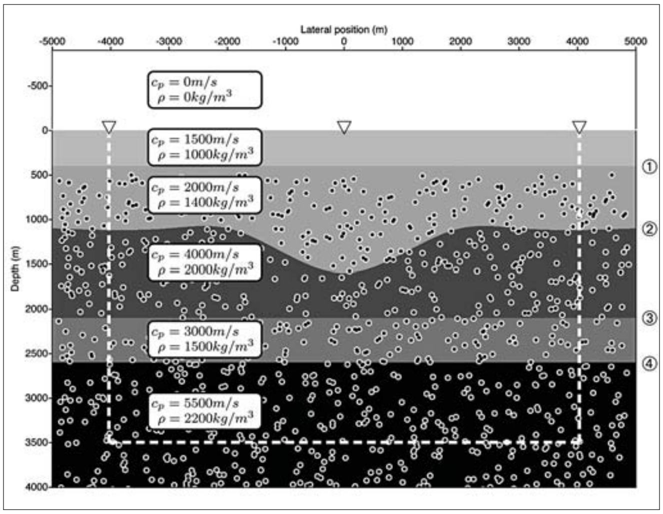

Figure 5. *(Figure 2 of Thorbecke and Draganov): A layered model and randomly distributed sources (black dots). The receivers are placed on the free surface at zero depth. The dashed line indicates positions of regularly distributed transient sources.*

tion of multiples from pure and mode-converted multicomponent data by Juanjuan Cao and George A. McMechan. AE D. J. Verschuur's remark: This paper handles a method which is not the mainstream: predicting and subtracting converted-wave events from elastic data. It builds upon knowledge from prediction of multiples and may be helpful to remove some dominant converted waves from seismic data before PP imaging (and potentially handle them separately).

4) *Investigation of injection-induced seismicity using a coupled fluid flow and rate/state friction model* by Mark W. McClure and Roland N. Horne. AE Leo Eisner's remark: This is a very interesting article bringing ahead our understanding of seismicity due to hydraulic stimulations. It uses a new innovative approach to predict the size of induced microseismic events.
5) *Magnitudes of induced earthquakes and geometric scales of fluid-stimulated rock volumes* by Serge A. Shapiro, Oliver S. Krueger, Carsten Dinske, and Cornelius Langenbruch. AE Shawn Maxwell's remark: The paper is of interest because it highlights the important issue of seismic hazard associated with fluid injections.
6) *Monitoring a shallow subsurface gas flow by time-lapse refraction analysis* by Hossein Mehdi Zadeh and Martin Landrø. AE Miguel Bosch's remark: The approach of 4D refraction is interesting.
7) *Common-image gathers in the incident phase-angle domain from reverse-time migration in 2D elastic VTI media* by Qunshan Zhang and George A. McMechan. AE Isabelle Lecomte's remark: The paper is well written and addresses a difficult but exciting topic (CIGs in angle domain for RTM in anisotropic, VTI cases), this in an apparently "cheap" manner, though this is only (yet) demonstrated in 2D and for a synthetic case (but Marmousi-2).
8) *Finite-difference modeling experiments for seismic interferometry* by Jan Thorbecke and Deyan Draganov. AE Joe Dellinger's remark: In their paper Jan Thorbecke and Deyan Draganov provide a code framework for testing interferometry. This should be useful both as an educational tool, but also so readers can perform their own tests using the same code and starting from the same worked-out examples the authors demonstrate in their paper.

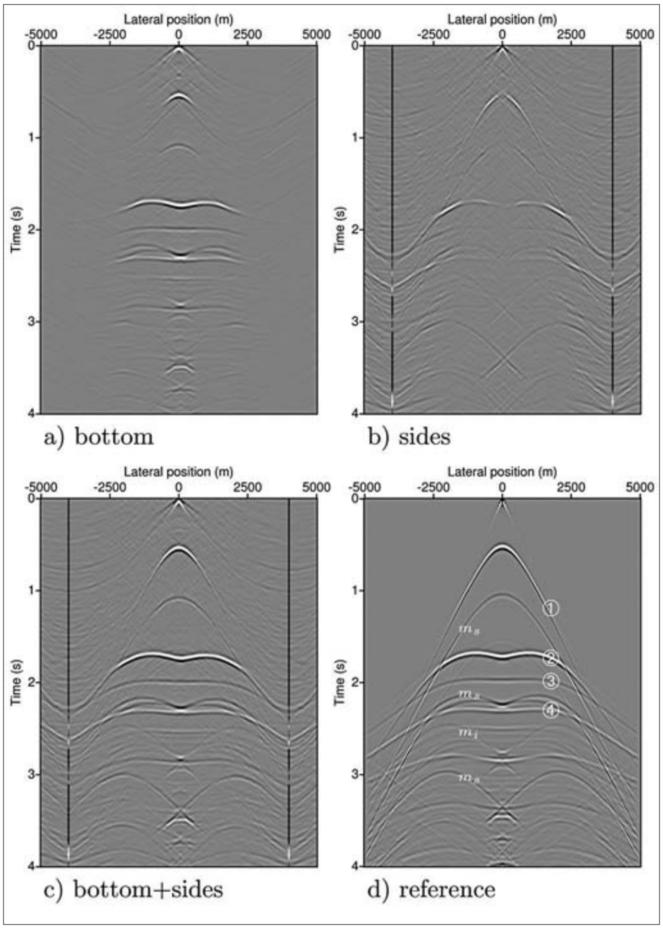

Figure 6. *(Figure 3 of Thorbecke and Draganov): The retrieved reflection response for a virtual source placed in the middle of the free surface using (a) only sources at the depth level of 3600 m, (b) only sources along the sides of the contour, and (c) all sources along both the sides of the contour and the free surface. The reference result by modeling with an actual source is shown in (d). Note that outside the lateral extent of the contour (|x| > 4000) the retrieval is not correct. The left, right and bottom edges of the wavefields are tapered with a 450-m transition zone to suppress reflections from these sides. The numbers in the reference result (d) refer to the numbered reflectors in the model. The "m" labels indicate a few multiples.*

9) *Near-source response of a resistive layer to a vertical or horizontal electric dipole excitation* by Nestor H. Cuevas and David Alumbaugh. AE Colin Farquharson's remark: This paper provides an analysis, albeit based on asymptotic formulae, of some of the fundamental physics of the EM method in a marine environment. TLE