3D Seismic Reflection Imaging with Microearthquake Sources recorded by Dense Nodal Arrays

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Reflection seismology with controlled sources often provides the highest resolution of any seismic technique. However, the application of the reflection method to probe all but the shallowest of structures is often inhibited by the substantial cost of artificial sources as well as logistical barriers to their deployment. Here we describe how reflection processing can be applied to recordings of microearthquakes to produce reflection imagery that approaches the quality of conventional controlled source (CMP) surveys. Such “passive” seismic reflection imaging has only recently become practical with the advent of nodal technology that can simultaneously record spatially dense arrays for substantial lengths of time. Two distinct approaches are illustrated here: re-datuming of microearthquake sources via interferometry and VSP imaging of microearthquakes sources. Examples from the eastern US and Iceland suggest that these methods represent a transformative approach to studying- and monitoring- magma and deep structure in tectonically active areas.

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