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A Deep-Water Seafloor Implosive Source with Applications for Off-Shore Instrumented Oil Fields and Sub-Sea Exploration

We have developed and tested a 1200 cu.in. (20 liter) underwater implosive seismic source. It is lowered by winch from shipboard and fired by sending an electrical signal down-wire; thus making it controllable with respect to time and depth. We have fired it repeatedly on the seafloor off S. California in over a thousand meters of water, generating interface waves recorded by Ocean Bottom Seismometers. There are several advantages in using an implosive source for seismic imaging beneath the seafloor. An implosion produces a clean, impulsive signal, without the bubble oscillations that airguns produce. The energy entering into the seafloor passes through a small Fresnel footprint, thus maximizing the resolution. Because the high pressure differential is not built up until it is on the sea floor, it is a deck-safe source subject to little, if any, regulatory oversight. In addition, the cylindrical rather than spherical shape of our implosion chamber should radiate energy non-isotropically, producing shear waves. Presently, it requires raising to the surface each time for reloading, but by connecting it to pressurized air, we believe it could be developed into the equivalent of a deep-towed water gun. One possible application would be to lower it to the seafloor in the midst of a producing and instrumented set of boreholes, firing it repeatedly in the same location, and stacking the resulting records to produce high quality vertical seismic profiles. Development supported by the National Science Foundation.