placed (usually laminae within pisolites). Replacement crystals range in diameter from 0.1 to 10 mm. Inclusions which reproduce primary fabrics are most commonly small (to 50 μm), irregular rounded blebs of unknown composition, but are rarely dolomite rhombs.

Generally associated with sulfate replacement zones are massive sucrosic dolomites displaying abrupt lateral transitions with unaltered limestones. These dolomites may form because of increased magnesium:calcium ratios in mixing-zone pore waters, because during replacement magnesium is not accommodated in the gypsum lattice.

Work is under way on the recognition of secondary carbonate fabrics related to these mixing-zone environments which would allow identification of gypsum replacement in rocks in which gypsum has totally dissolved or recrystallized.

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Reservoir Studies and Inversion of Seismic Traces

Inverting seismic traces is the means of finding a velocity or acoustic-impedance model from the recorded traces. Data are processed in preserved-amplitude mode. A wavelet inverse filtering results in a series of reflection coefficients. Reflection coefficients are simple functions of velocities and densities. A transformation of the series of reflection coefficients into relative velocities provides a display where the inverted seismic traces at a well location can be directly correlated to the sonic log.

Prediction of lateral changes affecting the formations intersected by the well is the most direct application. Provided the original surface seismic data have a sufficiently broad frequency spectrum, the inversion improves the detection of thin beds and lateral facies changes. Two examples of reservoir studies illustrate the application of the method: the first is in a deltaic sandstone and shale sequence; the second is a shelf-carbonate province.

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Glaciomarine Carbonate Sedimentation—Berriedale Limestone (Permian), Hobart, Tasmania, Australia

The Berriedale Limestone, an alternating sequence of impure limestone and calcareous shale with a few metabentonite layers, is associated with marine glacial sediments. There is less diversity of fauna (mostly bryozoans, brachiopods, and pelecypods) and allochems (only intraclasts) than in warm-water limestones. Lonestones (dropstones) commonly disrupt laminae. Quartz grains show glacial textures in SEM analysis.

Well-developed rhombs (up to 100μ), scalenohedra, elongated rhombic plates (length slow), and zoned and poikilotopic rhombic plates indicate low-magnesian calcite precipitated from normal seawater at a temperature of $<3°C$. The saturation of calcium carbonate fluctuated, ranging from undersaturated (pits, etchings, rhombic pores, and dissolution features) to saturated. The early diagenetic fabrics were extensively recrystallized.

The low-magnesium ($<0.3\%$) and high-manganese (201 to 912 ppm) concentrations confirm original calcite precipitation. The Ga, Rb, Ba, and total Fe concentrations reflect normal-marine conditions during deposition of the limestone units and brackish conditions (caused by melting of retreating, continental ice sheets) during deposition of the shale beds. The source of detrital material changed as a result of melting of icebergs during waning phases of carbonate deposition. The dropstones are clustered around limestone-shale contacts.

The vertical facies variation through shale-limestone-shale beds indicates that a gradual drop (~100 m) in sea level was followed by a rapid rise in sea level, corresponding to glacial and interglacial stages, respectively. The facies of shallowest water deposition occur slightly above the middle of most limestone beds. The limestone beds represent the coldest periods (glacial stages).

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Application of Oil and Gas Discovery Functions to Resource Assessment

As part of the data development underlying the LORENDAS model (modeling of worldwide Long-Range Energy Development and Supplies), it was necessary to estimate the relations between exploratory drilling and expected oil and gas discoveries for appropriate groupings of the United States sedimentary basins. These discovery functions are essentially negative exponentials, asymptotic to the "ultimately discoverable resources." In our initial approach we combined our analyses of discovery histories with estimates of discoverable resources obtained independently by others. However, further investigations resulted in the development functions by individual basins and depth zones, and revealed that ultimately discoverable resources might be estimated by direct extrapolation of such detailed discovery functions.

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Rates of Creep of Active Faults in Northwestern Houston, Harris County, Texas

Tilt-beams and recording horizontal extensometers installed across the surface trace of three active faults in northwestern Houston, Harris County, Texas (the Long Point, the Piney Point, and the Eureka Heights faults), recorded 34 events during the 14 months from April 1971 through June 1972. The Long Point fault is an east-northeast-striking regional growth fault that is downthrown toward the coast. The Piney Point fault is antithetic to it. The Eureka Heights fault is associated with the long-abandoned Eureka Heights field.

The events recorded lasted from 1 to 96 hours and were separated by periods of apparent inactivity lasting from 4 to 60 days. The vertical separation recorded during an event ranged from 0.09 to 3.33 mm. The annual rate of vertical separation recorded during the period of observation ranged from 6.7 to 34 mm/year. Normal and reverse faulting resulted in 77 and 23% of the ob-