tic terrigenous material at the foot of the Andean continental margin. In southern Chile, high rainfall and river runoff, combined with intense Pleistocene glacial activity, transport large volumes of detrital sediment to the offshore regions. Sediment bypassing the continental margin has produced a wedge-shaped deposit which swells to >30 km (>18.6 mi) in width and 2 km (6,560 ft) or more in thickness. Convergence of the Nazca plate with South America at the rate of 10 cm/yr indicates that these trench wedge deposits are no older than 300,000 years. Good piston core control over the wedge shows that very fine to medium-grained sand may locally constitute >50% of the stratigraphic section.

Two distinct depositional environments exist in the south Chile trench. South of 41°S lat., it appears that unconfined turbidity sheet flows spread radially from the mouths of submarine canyons to deposit laterally extensive, rhythmic sequences across the entire trench wedge. Seismic reflectors in this region are flat and continuous. In seven piston cores, graded sand beds can be correlated across 30 km (18.6 mi) by stratigraphic position, mineralogical content, ash content, radiometric dates, and characteristic grain-size distributions (i.e., mean size, sorting, skewness); individual sheet flows can be identified and studied spatially. Skewness is consistently positive; the mode is perhaps the most descriptive grain-size parameter since it most closely reflects the carrying competency of the turbidity current at the time of deposition.

At 41°S lat., an axial channel (up to a few 100 m in depth) develops in the trench wedge, trending northward along the gravitational gradient. Sediments may be transported parallel to the margin, via the axial channel, hundreds of kilometers from their canyon mouth source. In this region, submarine fans develop at the mouths of submarine canyons, prograding across the trench wedge and displacing the axial channel seaward; the fan distributaries become confluent with the main axial channel. Tensional faulting in the subducting oceanic basement commonly displaces the overlying trench strata; these normal faults can influence the position of the axial and fan channels. Alternating periods of deposition (characterized by flat-floored channels, levees about 50 m [165 ft] high, and graded silt and sand facies) and periods of erosion and/or winnowing (characterized by V-shaped furrows; reflection hyperbolics; seismic reflectors truncated against erosional scarps; and massive, nongraded, laminated sand facies) combine to produce complex fan morphologies (such as inactive or remnant lobes, hanging valleys, and possibly braided channels) and sedimentary facies that change rapidly over space and through time.

Late Pleistocene to Holocene sedimentation rates in the Chile trench range from several centimeters to >1 m/1,000 yr (>3 ft/1,000 yr). Erosional hiatuses and a variety of depositional environments contribute to the wide range of sedimentation rates.

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Late Eocene and Early Oligocene Carbonate Sedimentation in the Deep Sea

The transition from carbonate-poor late Eocene sediments to carbonate-rich early Oligocene sediments undoubtedly reflects a major reorganization of the way in which carbonate was fractionated between shelf regions and deep basins. During Eocene time carbonate was being deposited on the shelves marginal to the extensive Tethys Sea, whereas in Oligocene time carbonate sedimentation on the continental shelves decreased, but increased in the deep sea. In the deep sea, this facies change represents a lowering of the carbonate compensation depth (CCD) with the magnitude of the drop varying in a systematic fashion from one ocean basin to another. The CCD drop was most dramatic in the equatorial Pacific, sinking nearly 1,500 m (4,900 ft) in less than 2 m.y. Both the magnitude and abruptness of this drop in the CCD decrease steadily away from the equatorial Pacific. In the South Pacific and South Atlantic, the CCD drop across the Eocene/Oligocene boundary was on the order of 1,000 m (3,280 ft) and 750 m (2,460 ft) respectively. Similarly, in the North Atlantic, not only was the magnitude of this drop reduced to only several hundred meters, but it appears to have occurred over a prolonged period of time.

By early Oligocene time a distinct latitudinal trend in the depth of the CCD existed in the Atlantic Ocean. The maximum depth was centered around 10°N paleolatitude and most probably marked a zone of high productivity. Above 40° north and south lat., there was a definite shoaling of the CCD. This is a feature that also occurs in the present-day Atlantic and may be due to the production of cold bottom waters at high latitudes.

Time series carbonate records from sites located above the CCD show varying responses across the Eocene/Oligocene boundary. DSDP Site 219 (Indian Ocean) and Site 292 (western equatorial Pacific) show no change in carbonate content across this boundary indicating that they were consistently above not only the CCD but the lysocline as well. In contrast, Site 77B (eastern equatorial Pacific), Site 277 (southwest Pacific), Site 363 (southeast Atlantic), and E128 (Gulf of Mexico) all show decreases of 10 to 25% across the boundary in conjunction with a distinct dissolution event. All of these sites may be recording a shoaling of the lysocline that accompanied the drop in the CCD across the Eocene/Oligocene boundary.

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Influence of Tectonic Terranes Adjacent to Precambrian Wyoming Province on Petroleum Source and Reservoir Rock Stratigraphy in Northern Rocky Mountain Region

The perimeter of the Archean Precambrian Wyoming province can be generally defined. A Proterozoic suture belt separates the province from the Archean Superior province to the east. The western margin lies under the Western Overthrust belt and extends at least as far west as southwest Montana and southeast Idaho. The province is bounded on the north and south by more regionally extensive Proterozoic mobile belts. In the northern belt, Archean rocks have been incorporated into the Proterozoic rocks, but the southern belt does not appear to contain rocks as old as Archean. The tectonic response of these Precambrian terranes to cratonic and continental margin vertical and horizontal forces has exerted a profound influence on Phanerozoic sedimentation and stratigraphic facies distributions. Petroleum source rock and reservoir rock stratigraphy of the northern Rocky Mountain region can be correlated with this structural history. In particular, the Devonian, Permian, and Jurassic sedimentation patterns can be shown to have been influenced by articulation among the different terranes comprising the ancient substructure. Depositional patterns in the Chester-Morrow carbonate and clastic sequence in the Central Montana trough are also related to this substructure. Further, a correlation between these tectonic terranes and the localization of regional hydrocarbon accumulations has been observed and has been useful in basin analyses for exploration planning.