Meldahl, K. H. 1990. Paleoenvironmental and stratigraphic implications of taphonomic processes: Case studies from Recent and Pleistocene shallow marine environments. Ph.D. dissertation. University of Arizona. Tucson, Arizona. 440 pp.

Taphonomic data can be applied to problems in paleoenvironmental analysis, stratigraphy and paleobiology. Ecologic and taphonomic data from molluscan assemblages in Recent clastic shallow marine environments (northern Gulf of California, Mexico, and Cape Cod, Massachusetts, U.S.A.) furnish different and complementary types of environmental information. Ecological data (species composition, trophic and life habit data) are regulated principally by substrate variation. In contrast, taphonomic data (abrasion, fragmentation, corrosion, bioerosion and encrustation) variously track shifts in surface residence time of shells, water energy, and tidal submergence time. Taphonomic contrasts between sedimentary environment arise because shells in different environments are altered along distinct "taphonomic pathways". Variation in residence time, water energy and tidal submergence time elicit responses in unique suites of taphonomic attributes. Taphonomic processes affect the distribution of fossils in strata, and this has important stratigraphic and paleobiologic ramifications.

Shell concentrations in Pleistocene shallow marine strata in the northern Gulf of California formed either as beach ridge accumulations, tidal channel lags, autochthonous communities, or "unconformity beds". The latter are significant stratigraphic markers, capping angular unconformities. The "unconformity beds" are identified taphonomically as transgressive lags derived from beach face reworking during erosion of structural bulges that formed by periodic deformation along the Pleistocene shoreline. These shell beds are products of sedimentary processes along tectonically active continental margins.

Preservational incompleteness of fossils hampers reconstruction of patterns of mass extinction, because biostratigraphic last occurrences nearly always underestimate times of lineage extinction. The distribution of biostratigraphic last occurrences of mollusc species in sediment cores from a Recent tidal flat indicates that sudden extinction can appear gradual, due to error in biostratigraphic range endpoints (Signor-Lipps effect). Extinction is typically not accurately recorded for species with less than 15% stratigraphic abundance (i.e. occurring in less than 15% of the sample intervals). Extinction simulations demonstrate that stratigraphic abundance and last occurrence data (readily available in the fossil record) can be used together to distinguish between sudden, stepwise and gradual patterns of mass extinction.