MODELING EVOLUTION OF PHANEROZOIC SEDIMENTARY ROCKS AND OCEAN SALINITY

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The mass-age distribution of Phanerozoic sediments forms an exponential decay curve, reflecting the cannibalistic behavior of the system - new sediments are formed mostly from the erosion of older sediments. Additions to the system from weathering of igneous rocks, and losses through metamorphism and subduction are relatively small in comparison with the overall rate of sediment cycling. Because strata accumulate in thin widespread layers, sedimentary cycling must proceed in such a way that young sediments are more likely to be eroded than older sediments, and selective cycling of different lithologies is impossible. Because of these properties inherent to the system, it is possible to determine the amounts of sediment of each lithology and age eroded to form young sediment. Variations from the expected distribution reflect weathering of crystalline rocks and maturation of older sediments as they are recycled. The dissolved salt in the ocean constitutes a special reservoir of the sedimentary system. To determine past ocean salinities, we assume that evaporites and saline pore waters on land follow the same rates of sedimentary cycling as other sedimentary materials and that the major sources of salt delivered to the sea have been erosion of evaporite deposits and release of saline sedimentary pore waters. We conclude that during most of the Cenozoic and during all of the earlier Phanerozoic, the ocean was saltier than it is today. In the Paleozoic and Triassic the ocean mean salinities were in the low 50's to high 40's.