C SALT (Smith, 1989) is a thermodynamic, chemical equilibrium model. The program was written to be flexible enough to speciate a wide range of chemical solutions containing the major solute species. Predictions of C SALT are based on equilibrium chemistry for the formation of ion pairs, ion complexes and precipitation of solid phases. Rates of reactions, oxidation–reduction potential and solution–surface interactions are not considered in C SALT.

Sea water has the molar ion concentrations presented in Table 15–1. If sea water is speciated at 25°C and 1 bar (0.1 MPa) atmospheric pressure, the ionic strength is calculated to be 0.6449 m and dolomite [CaMg(CO₃)₂] and magnesite [MgCO₃] are predicted to precipitate at a pH of 8.0. Selected output from C SALT for this problem is presented in Table 15–2. The ionic strength is less than the typically measured 0.7 m (Whitfield, 1979). The reason that the ionic strength is less than expected is because the equilibrium model predicts the formation of two solid phases. However, dolomite rarely precipitates at earth surface pressure and temperature because its formation is kinetically limited (Stumm & Morgan, 1981, p. 583). Magnesite also is rarely found, and its formation also may be limited (Lindsay, 1979, p. 450). This anomaly is an example of the limitations of equilibrium chemical predictions.

The speciation of sea water may, however, be recalculated without the precipitation of dolomite or magnesite. Selected output from C SALT for this