INTRODUCTION

As carbonate sediments become buried, major changes in fabric, composition, rigidity and porosity tend to occur. Character of burial diagenesis is controlled by precursor sediment character, pore fluid, lithostatic and tectonic stresses, evolving aqueous chemical influences, and time for kinetically slow processes to have effect.

Diagenetic changes that take place during burial can be divided into three groups: processes which reduce porosity, processes which maintain porosity and processes which enhance porosity.

Processes which reduce porosity are physical compaction, chemical pressure solution (commonly called chemical compaction), cementation, and growth of authigenic minerals.

Processes which maintain porosity (or otherwise provided rigidity) are: early cementation, increased pore fluid pressure (which reduces lithostatic stress), and early emplacement of hydrocarbons (inhibiting aqueous chemical reactions).

Processes which can enhance porosity during burial are dolomitization, fracturing by tectonic or lithostatic stresses (pervasive or facies selective) and chemical leaching (by acidic waters provided by organic diagenesis within the rock or introduced from elsewhere).

At present, the most controversial aspect of burial diagenesis

is the timing and relative roles of the porosity reducing processes. Included is: (a) difficulty in differentiating early cementation from later cementation, (b) disagreement as to relative importance of physical compaction and pressure solution, and (c) discord as to the relationship between pressure solution and cementation and dolomitization.

As resolution of these controversies is fundamental to understanding burial diagenesis, this paper will focus on, and attempt to provide, criteria for distinguishing products of pressure solution and solution transfer from other compaction, cementation and dolomitization.

AN APPROACH TO LIMESTONES UNDER STRESS

Wanless (1979, p.438) offered the following approach for considering the response of limestones under stress. "It is useful to consider limestones as packages of crystals which: (a) will have differing resistance or responsiveness to change and (b) will or will not contain impurities that would cause them to behave differently than when pure. Change under stress can take the form of physical compaction, physical deformation (plastic or brittle), neomorphism (as micrite conversion to microspar or aggrading pseudospar), or solution. Influencing impurities can be chemically inert particles (as siliciclastic sand, silt, and clay), ions in calcite structure (e.g. Mg$^{2+}$, Folk, 1974) or other ions available to the interstitial fluid (free ions, adsorbed ions, ions in unstable minerals). Impurities can modify either the physical or chemical response of the limestone to stress".

"A resistant unit is an entity of grain- to bed-scale having structural resistance to change. A unit may be resistant because of crystal size, mineralogy, crystal chemistry, grain/crystal packing, fabric, permeability and extent of precursor cements. A structurally resistant unit, stressed excessively, will first yield at foci of stress, along slightly less resistant internal surfaces and at boundaries with other units. The bulk of the unit will remain unchanged. 'Unit', as used here, is comparable to 'iden' defined by Logan and Semeniuk (1976)".

"A responsive unit is one that does not have internal structural resistance to stress. This unit, if homogeneous, will respond to excessive stress, if uniformly applied, by uniform change throughout the unit: analogues are a sponge squeezed between two plates or a spring stretched. If the responsive limestone unit is not homogeneous or if the applied stress is not uniform, the extent of change will be variable through or along the unit. Pressure solution in responsive units would not form