This is accompanied by a review of the techniques for measurement and description. The contributions to this Congress are emphasized in the text whenever possible.

ON THE SCALE OF THE CRYSTAL

Composition and Structure

An understanding of why a rock exhibits a given mechanical behavior must begin with consideration of the constituent crystals (Albissin, 1966). Of primary concern are composition and structure and the resulting crystallographic control of certain physical and mechanical properties. Dislocation densities, impurities, and other imperfections are ubiquitous in real crystals and are not treated separately here. As an obvious example, one would expect crystals of halite (NaCl) and quartz (SiO_2) to exhibit radically different mechanical behavior under specified conditions. The abundance of likely slip systems in halite coupled with its high symmetry and low critical resolved shear stress for slip, τ_c, compared to similar considerations for quartz would suggest that halite should be weaker and more ductile than quartz. Indeed, this is the case. It is especially illustrative, however, to examine the differences in behavior that exist for calcite and dolomite because their structures are not radically different and they differ chemically only in that about half of the calcium ions in the calcite structure are replaced by magnesium ions in dolomite (Figure 1). The mechanical differences between the two minerals are large and are manifest primarily in the different operative slip systems (Figure 1) and in the magnitude of τ_c to initiate the respective slip systems (Figures 2 and 3). As will be discussed later, these differences in the behavior of calcite and dolomite crystals are related to equally different ultimate strengths and ductilities between the corresponding rocks.