Fig. 2. $\delta^{13}C$ vs. $\delta^{18}O$ diagram. The numbers along the curve correspond to the degree of Raleigh degassing.

instead of being depleted as they should be if they were residues resulting from the $^{13}C$-enriched $CO_2$ losses (Fig. 1). On the other hand, these carbonates are systematically depleted in $^{18}O$. The magnitude of the $^{18}O$ depletion is variable (Fig. 2). Thus no systematic correlation between $^{18}O$ and $^{13}C$ was observed as expected from the Rayleigh model or the batch model for $CO_2$ loss (Fig. 2), nor was any clear relationship observed between the carbon and oxygen isotopic shifts and CaO + MgO contents of the shock clasts. The spread of the carbon and oxygen isotopic composition is probably due to a variety of processes that may affect C and O during the shock. Several explanations can be suggested for the volatile release from sedimentary rocks: (1) degassing of $CO_2$ with a peculiar carbon isotope fractionation coefficient ($\alpha < 1$, $CO_2$ preferentially concentrates $^{13}C$), (2) other reactions with production of CO or C, or (3) oxygen isotope exchange with coexisting silicates. Moreover, the absence of CaO + MgO enrichments in the shocked clasts, which is a general feature, may indicate that substantial amounts of CaO + MgO are mobilized during the shock processes since original sedimentary samples contain up to 66 wt%. The modalities of this inferred mobilization of CaO + MgO are still unknown.

However, for some samples, late secondary processes may have partly altered the primary characteristics (nature) of the residues resulting from the volatile release because carbonate crystals are observed along cavity walls (bubbles, cracks). It suggests that some C-rich fluids ($CO_2$?) were pervasive during the formation and the cooling of the polymict breccia. In these samples, the observed $^{13}C$ enrichments can therefore be partly explained by the trapping of some heavy $CO_2$ released during the shock process itself.

**References:**
Fig. 2. Generalized lithologic logs of the Manson M-1 and M-2 cores.

The basal unit in the core was another sequence of sedimentary clast breccia, 51 m thick, and similar to the upper interval in the core. The two sedimentary clast units, like the lithologically similar unit in the M-1 core, probably formed as debris flows from the crater rim. The middle, nonbrecciated interval is probably a large, intact block of Upper Cretaceous strata transported from the crater rim with the debris flow. Alternatively, the sequence may represent the elusive postimpact lake sequence.

Additional drilling is planned for the late spring and summer of 1992. Targets include structurally preserved Upper Cretaceous strata on the Terrace Terrane, a zone of complete melting, and postimpact lake sediments in the Crater Moat.