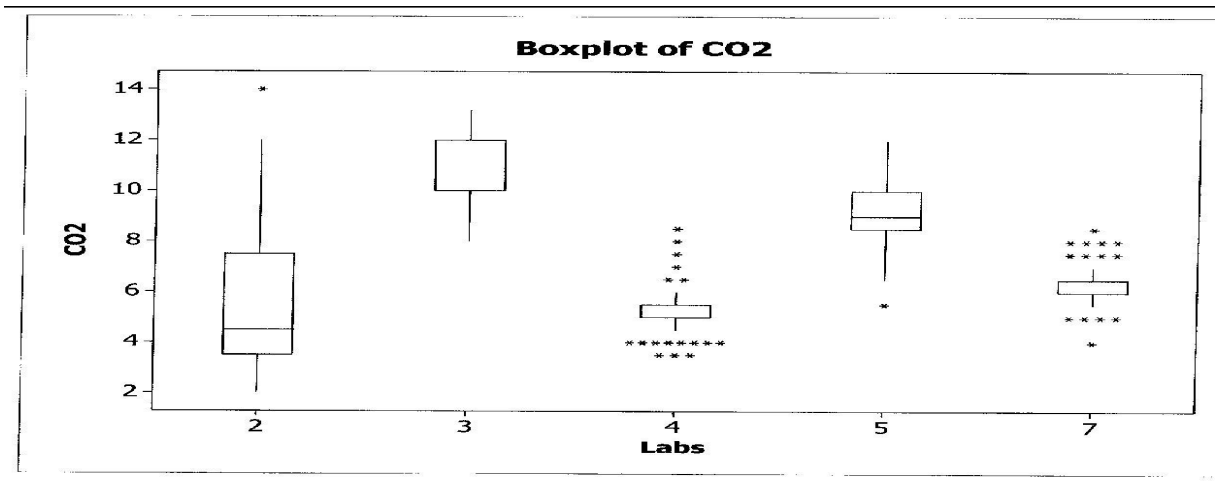

Figure 7.5. Range in CO_2 content of leach column atmosphere between laboratories. CO_2 concentration given in percent by volume.

A plot of CO_2 versus alkalinity is shown in Figure 7.6. This plot shows no distinct linear relationship with alkalinity in leaching column effluent as the dependent variable, and carbon dioxide content (i.e. CO_2%, partial pressure) as the independent variable. Theoretically, alkalinity produced from weathering this calcareous shale sample should increase in proportion to increasing CO_2 content within the leaching column (see Figure 1.1), but that relationship is not evident in this data set. However, several patterns of variation are evident in this bivariate plot. Lab 2 exhibited the greatest scatter of points, having the largest range in CO_2 and alkalinity. Labs 4 and 5 showed the least scatter of data points. Curiously, the range in alkalinity concentrations for Lab 5 is between 500 and 600 mg/l over a CO_2 range of 6.2 to 11%; for Lab 4 the range in alkalinity is 400 to 500 mg/l over a CO_2 range of 3.8 to 7.8%. This implies that relatively high alkalinity concentrations can be produced in leaching columns having far less than the 10% target value. The most unusual bivariate relationship is in the data from Lab 3 where there is a cluster of data points with relatively high alkalinity concentrations and a second cluster of four data points where relatively low (i.e. 50 to 100 mg/l) alkalinity is produced over a CO_2 range of 8.5 to 13 percent.

The gas flow rate of the gas mixture entering the leaching columns was controlled by Rotometers, which were intended to promote consistency in meeting the target 10% CO_2 value in each of the 9 leaching columns in each lab. Labs 4 and 5 very consistently maintained a gas flow rate of 1.0 liters per minute (lpm). Lab 2 typically reported gas flow rates of 0.2 to 0.35 lpm; Lab 3 was consistently at 0.35 or 0.45 lpm; while Labs 6 and 7 were typically higher than 1.0 lpm, with median values of 1.9 lpm in numerous cases. The gas flow rate is probably not independent of the method of gas mixing employed in the leaching test and the partial pressure of CO_2 in the columns. The three methods that may be used are: (1) a single tank of gas containing 10% CO_2, 10% oxygen and 80% nitrogen, (2) a tank of CO_2 mixed with a second tank of compressed air, or (3) a tank of CO_2 mixed with the "house air" line in the laboratory.