Interpolating the quantile values in the SedSASample class

To replicate the old-fashioned graphic methods for estimating sediment grain size quantiles for analysis, as per Folk and Ward (1957) we must invoke a double-dose of 2-D, simple linear interpolation. Even though the absissa is in sediment particle size phi units which are based 2 logarithms we treat the x-axis scaling as a linear one. The ordinate on the other hand, representing the sieved fraction cumulative weight percent, is linear throughout.

-the data is stored in a Python Pandas dataframe

to estimate the k^{th} quantile:

1. search the sample column and extract all records (rows) whose cumulative weights are less than that of the quantile value (D) you are searching: *p=cum_phi.query('S2 <'+str(d))*
2. search the sample column and extract all records (rows) whose cumulative weights are greater than that of the quantile value (D) you are searching: *q=cum_phi.query('S2>'+str(d))*
3. for the group of query results (records) that are less than D extract and store the last record (slice position: -1). this would be the record whose cumulative weight percentage is closest to, but still less than, D
4. for the group of query results (records) that are greater than D extract and store the first record (slice position 1). This would be the record whose cumulative weight percentage is closest to, but still greater than, D

- The computation then proceeds as a proportionality equation of the form:

$$(\frac{D_k - CumWt_{lowerbnd}}{CumWt_{upperbnd} - CumWt_{lowerbnd}})$$

the resulting quotient is then multiplied by the difference between the bounding Phis:

$$\Phi_{upperbnd} - \Phi_{lowerbnd}$$

finally, the resulting product is added to the lower bounding Phi. The entire equation looks like this:

$$D\Phi = ((\frac{D_k - CumWt_{lowerbnd}}{CumWt_{upperbnd} - CumWt_{lowerbnd}}) * (\Phi_{upperbnd} - \Phi_{lowerbnd})) + \Phi_{lowerbnd}$$