Cl isotope presentation

By Chris Eastoe

Page 1: Diagrams illustrating the small isotopic effect of crystallization of halite.

Top: Ranges of ^{*37}Cl expected for evaporation of seawater in a basin with continual replenishment of seawater, and in a basin with no replenishment of seawater after the initial input.

Bottom: Variation of ^{*37}Cl in a batch of seawater evaporated until K and Mg salts appear. Note the small enrichment of halite (predicted as 0.24‰) relative to coexisting NaCl solution. The time scale is arbitrary. First appearance of halite and hexahydrite indicated by arrows.

Page 2: Diagrams illustrating the magnitude of isotopic fractionation resulting from linear diffusion of chloride ion at 25EC from an infinite source with *37Cl = 0.0‰ into pure water.

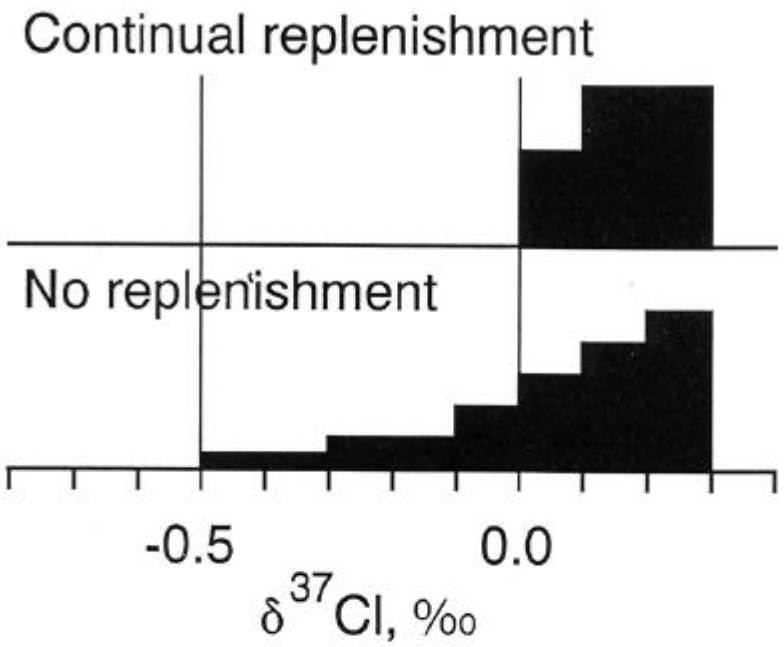
Top: Profiles of ^{*37}Cl as functions of distance from source and time elapsed since initiation of diffusion.

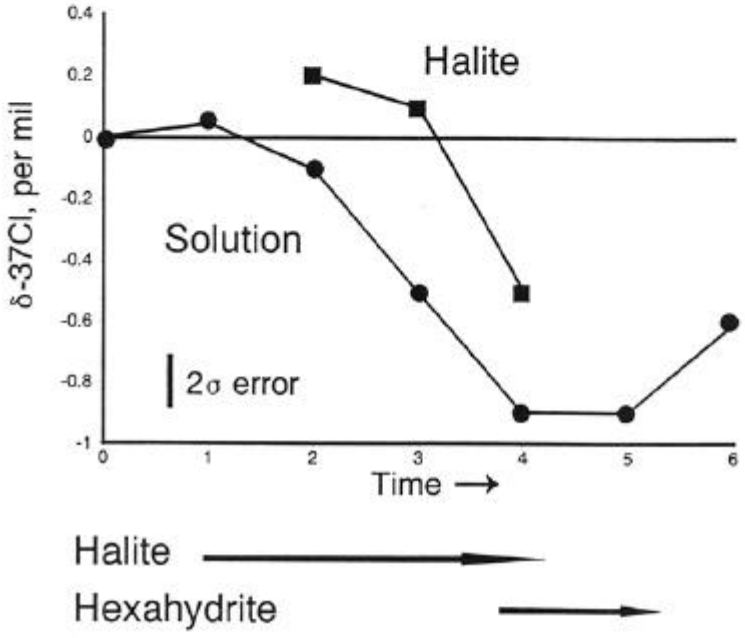
Bottom: Profile of *37Cl as a function of c_x/c_o where c_x is the Cl concentration at distance x from the source, and c_o is the source concentration. The curve is the same, regardless of time elapsed. Solutions with ^{*37}Cl = -2‰ have a Cl concentration that is 0.2 of the source concentration.

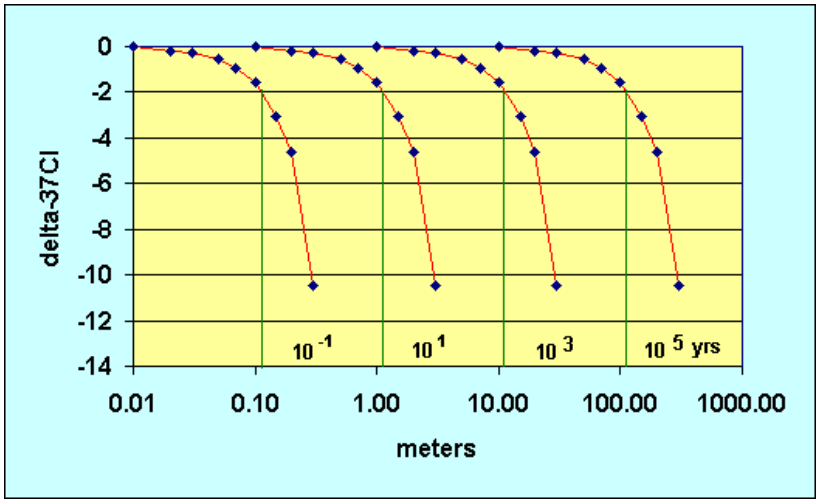
Page 3: Values of ^{*37}Cl in near-surface sediments in southern Arizona, compared with the ^{*37}Cl ranges of ideal marine evaporites.

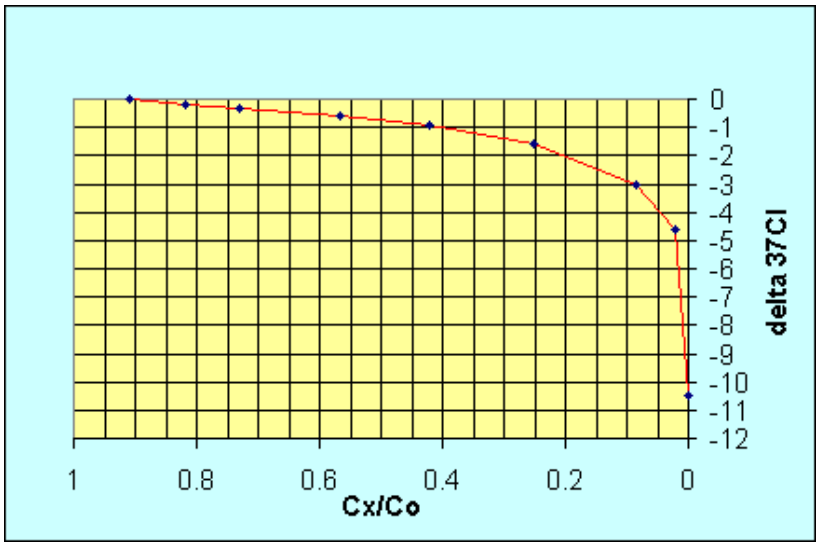
Sediments from Safford Basin have positive values, some extreme for the Cl isotope system. If generated by diffusion, they represent residual chloride, probably the result of multiple cycles of wetting and drying with diffusive loss of chloride in each cycle.

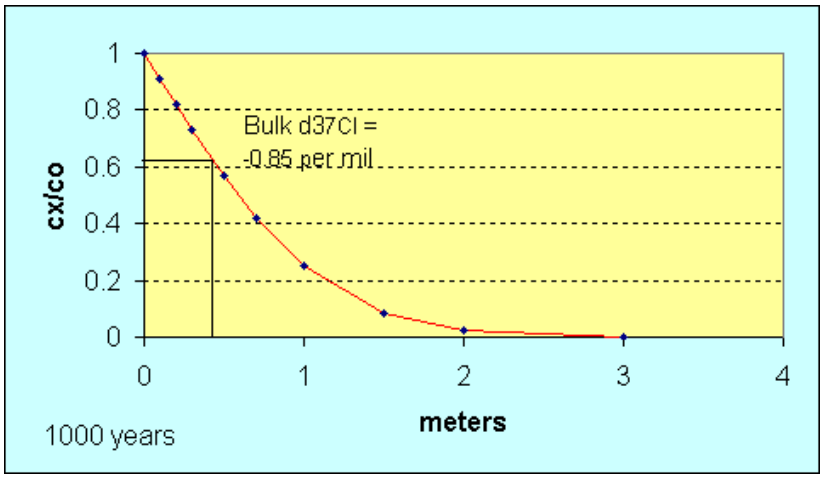
Two negative ^{*37}Cl values for soil from Tucson may indicate diffusion of chloride away from a near-0‰ source.

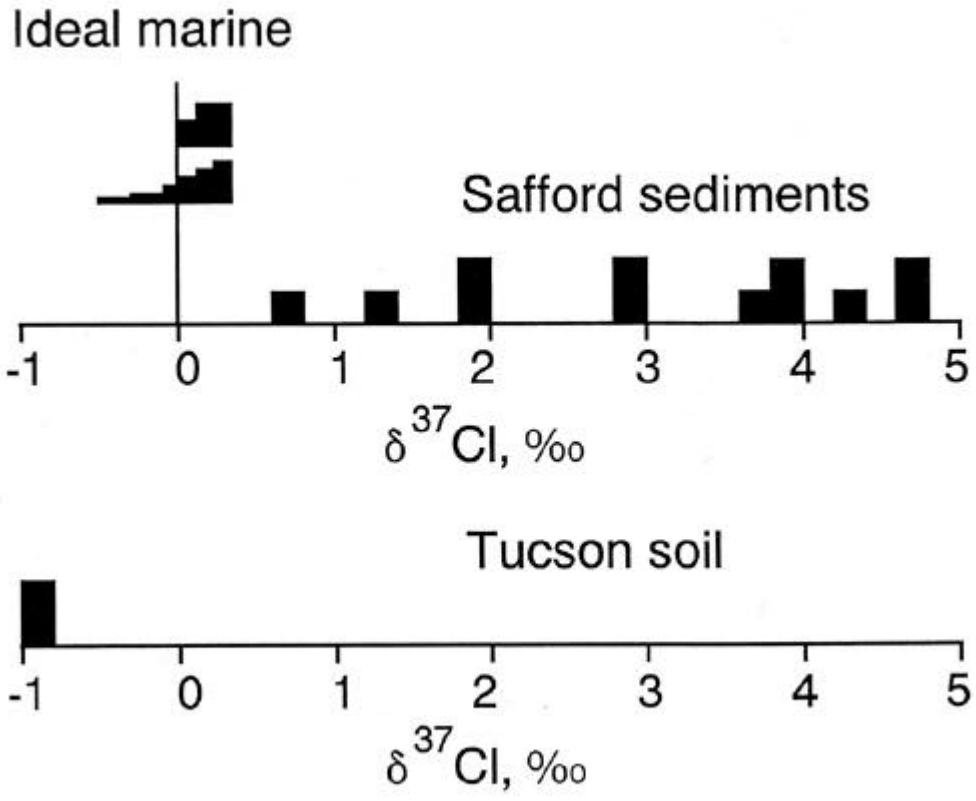

Continual replenishment
No replenishment
-0.5
0.0
δ 37Cl, ‰


δ-37Cl, per mil
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
1
2
3
4
5
6
Time →
Halite
Solution
2σ error
Halite
Hexahydrite


0
-2
-4
-6
-8
-10
-12
-14
delta-37Cl
10 -1
10 1
10 3
10 5 yrs
0.01
0.10
1.00
10.00
100.00
1000.00
meters


0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
delta 37Cl
1
0.8
0.6
0.4
0.2
0
Cx/Co


1
0.8
0.6
0.4
0.2
0
cx/co
Bulk d37Cl =
-0.85 per mil
0
1
2
3
4
meters
1000 years


Ideal marine
Safford sediments
-1
0
1
2
3
4
5
δ37Cl, ‰
Tucson soil
-1
0
1
2
3
4
5
δ37Cl, ‰