
Ancient TL

www.ancienttl.org · ISSN: 2693-0935

Berger, G., Mulhern, P. and Huntley, D., 1980. *Isolation of silt-sized quartz from sediments*.
Ancient TL 4(2): 8-9. <https://doi.org/10.26034/la.atl.1980.036>

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ISOLATION OF SILT-SIZED QUARTZ FROM SEDIMENTS

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In our on-going study of the TL properties of sediments we have found it useful to isolate quartz from other phases. For fine grain sizes (5-10 μ , say) the usual density and magnetic methods are tedious and ineffective and will not permit the separation of quartz from plagioclase because their densities and magnetic susceptibilities overlap. Chemical methods seem very promising but most of these do not remove quartz efficiently or require using temperatures above 50°C.

For some months we have obtained very good results with hydrofluosilicic acid (H₂SiF₆). Given the proper pre-treatment, this acid will selectively dissolve the major non-quartz components, leaving the quartz untouched. The susceptibility of minerals to attack by H₂SiF₆ has been attributed to the extent of aluminum in tetrahedral substitution (Syers et al 1968). Hence, most aluminosilicates are attacked while quartz is unscathed. Because H₂SiF₆ removes Fe oxides and hydrous Fe oxides very inefficiently, we initially treat our samples with 0.1N HCl. Some magnetic minerals will still remain but in much smaller amounts than feldspars and quartz for most sediments.

We have removed these magnetic minerals by using a Frantz magnetic separator in a "wet mode" (Greene and Cornitius 1970, Parsonage 1979). We use the modification of Greene and Cornitius without a feeder and with the vibrator turned off to minimize turbulence. Furthermore, rather than using acetone as the suspending medium we use a 0.01N sodium oxalate solution (deionized water) to prevent the flocculation which sometimes occurs in acetone. The price we pay is a much longer (~ 4 hours) feed-through time. The sample is added periodically with a spatula. We have found that since the magnetic minerals contribute only about one-tenth the TL of a comparable amount of quartz, and since the magnetic separation is relatively tedious, one may dispense with this step and apply the H₂SiF₆ acid immediately after the HCl step.

The use of H₂SiF₆ to isolate quartz was suggested as early as 1933 (Knopf 1933) and has been described more recently by Syers et al (1968), Sridhar et al (1975) and Jackson et al (1976). For convenience to the reader we outline here our adapted procedures.

The acid is pretreated by adding 4-88 μ (since our samples are 4-11 μ) commercial silica (sized from 240 mesh commercial silica powder), and storing at 4°C for at least three days with occasional stirring. Prior to use of the acid the commercial silica is centrifuged out. Sufficient acid is added to the sample to give a liquid:solid weight ratio of 40:1. This is kept at \sim 18°C and stirred at least twice a day. The digestion time depends on the amount of non-quartz present which we estimate from optical examination in oils of the 10-40 μ size fraction, assuming that the 4-11 μ fraction has a similar composition. Following Jackson et al (1976) we store the mixture for 3 days for each 50 mg of plagioclase and then double this for good measure. The purity of the final residue (removed by centrifugation) is checked by XRD powder patterns. For a sediment that has not been heavily weathered this procedure yields a residue of at least 90-95% quartz. Since the remaining contaminants are not feldspars but mainly opaques, they probably contribute negligible TL. For heavily weathered samples, pre-treatment with 6N HCl (rather than 0.1N HCl) might be preferred.

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