POLYMER MUD: PROBLEMS AND SOLUTION

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During 1986 and early 1987, we noticed a marked reduction in the abundance of nannofossils present in samples from offshore Gulf of Mexico exploratory wells. This problem was of great concern to us and, for a time, brought into question whether nannofossil biostratigraphy would be as useful in deep water settings as we had earlier hoped. Strata deposited at low depositional rates in a bathyal environment, above CCD, should contain abundant nannofossil floras. Their near absence in samples from wells drilled into such sediments was a mystery.

In the summer of 1987, during the drilling of the first wells at Prospect Auger (Garden Banks block 470 and 471), the technician who prepared our slides reported increasing problems with sample processing. The standard procedure at that time was: A small cut (approximately 2 cc) of unwashed cuttings was placed in a vial, water added and mixed using a vortex mixer. A drop of the resulting suspension was placed on a microscope slide using a capillary tube. Finally the slide was dried on a hot plate and a cover glass was affixed.

Samples from the wells in question would bead up on the slide and not spread evenly. The technician sent us a representative batch of the problem samples. They exhibited some very unusual properties. When the samples were mixed with water in the vial, the resulting suspension had a thick plastic-like consistency viscous enough to stand up a capillary tube. If the samples were mixed with more water in a larger container, a similar consistency resulted without apparent loss of viscosity. Once water was added, any attempt to remove it by physical means was unsuccessful. Several samples were centrifuged for ten minutes at 3500 r.p.m. without any material coming out of suspension. When the samples in the vials were oven-dried the sediment retained very much the same volume as when wet, and was overgrown by an array of fibrous crystals.

The unusual characteristics of the samples were intriguing and suggested a cause for the paucity of our observed floras. The ability of the samples to occupy any reasonable volume showed us that our specimens were more widely distributed in a larger volume of mud than previously. The assemblages were being diluted. We concluded that the unusual properties observed were not a natural phenomenon and some sort of polymer drilling mud was responsible. The problems proved to be due to salt polymer mud, which was first used successfully by Shell Offshore Inc. in June 1986 (Cheatham et al., 1987). This type of polymer solved a plethora of drilling problems but wreaked havoc on attempts at nannofossil biostratigraphy.

We initially tried rinsing the drilling mud off the cuttings. This proved unsuccessful as the polymer was tenacious and even a small amount produced the problems described above. The vigourous washing necessary to remove all the drilling fluids from the samples also removed most of the nannofossil bearing shale. Later experimentation also showed that the polymer reacted with any expandable formation clays along with the drilling mud. It was clear that the polymer had to be removed or neutralized, without removing the clay fraction. We consulted our drilling department and several drilling mud companies and received numerous suggestions; none worked. Research efforts in those circles generally are aimed at increasing and preserving the very properties we found undesirable. In late 1987, one mud company kindly provided us with samples of all their polymer products. Over a period of three months we experimented with the polymer samples and samples from the affected wells. Two chemicals proved to be effective in disassociating the polymer from the clay particles: sodium hypochlorite (chlorine bleach) and methanol. Both are equally effective, but methanol is flammable and more toxic so we elected to employ bleach. The entire procedure must be followed for successful results. Simply adding a few drops of bleach to your nannofossil preparation likely does more harm that good (see note in step 2 below).

Procedure

1. Place approximately 1 ml unwashed cuttings in a 15 ml centrifuge vial.
2. Add full strength bleach (or methanol) to the 12 ml mark.
   Note:Do not add water! Do not use dilute bleach! Gaffey and Bronnimann (1993) report that dilute bleach etches carbonates while full strength it has no effect.
3. Spin stir on a vortex mixer to thoroughly mix sample.
4. Place in a centrifuge and run at high speed (3500 rpm) for 30 seconds.
5. Decant liquid and retain residue in the centrifuge tube.
   Note:Steps 1-5 serve to break the bonds of the polymer to the mud. The polymer is still present. If the samples were used at this point the polymer-related problems would still occur.
6. Add water to the 12 ml mark; stir on a vortex mixer.
7. Centrifuge on high speed for 30 seconds.
8. Decant liquid; retain residue in the centrifuge tube.
   Note:The decanted liquid at this point is a gel-like substance that is either translucent or dark brown depending on whether lignosulfate is present in the mud system.
9. Repeat steps 6-8 until decantant is all water or desired viscosity is reached (usually two or three rinses).
   Note:We have found that a very small amount of polymer left in the sample enhances spreadability without significantly diluting the flora.
10. Make nannofossil slides in the normal way, from the residue.

Remarks

The use of various polymers in drilling fluids has become common place in oil and gas drilling operations since the mid eighties. Since that time, treating nannofossil samples for polymers has become part of our standard procedure. The effects of this procedure on our sample quality

is phenomenal. The number of fossils observed on a slide after the polymer has been removed has been found to be up to eight time greater than in the same sample before treatment. This procedure has had a profound effect on the quality of our interpretations. It is presented here in the hope that the technique will improve results of all workers who work with ditch cuttings from polymer mud systems.

REFERENCES

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