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LETTER TO THE EDITOR

Dear Sirs,

I have recently become aware of the interesting letter of Ambers and Bowman (2002) commenting on our discovery of a "substance" associated with the parchment of the Vinland Map (Donahue et al. 2002) found during our carbon-dating procedures: a substance labeled with post-bomb radiocarbon. They also focus on the means by which old parchment might best be prepared for the fraudulent creation of a Vinland Map; one could start with a genuine old document and then remove "any existing markings, probably by abrasion." In other words, create the Vinland Map on a palimpsest (Burleigh and Baynes-Cope 1983). However, Seaver (2004:361) notes: "None of the various scientific investigators have found indications of a palimpsest on the map parchment, so it is probably safe to assume that removal of earlier ink was not necessary."

Ambers and Bowman (2002) were the first, to my knowledge, to point out that our discovery might have some new significance in that while "dating of the parchment itself does not necessarily have any direct relevance to the question of the authenticity of the map drawn on it," our paper "has, however, brought something additional to the debate: there is a large amount of modern material on, or in, the parchment. The identification of this material would be of great interest, but would not necessarily resolve the debate over the authenticity of the map." I shall suggest a reason why the identity of the material is of *very* great interest, below.

They are right that each bit of new knowledge "proves" nothing of and by itself. There can be no "magic bullet" for proving authenticity, but we have also seen magic bullets that were widely accepted as "proving" forgery, which only proved to be untrustworthy. One can recall: 1) a heavy percentage of anatase (titanium dioxide) crystals of a size and shape that could only have been made after 1917 in the ink, and 2) an outline of Greenland that could only have been known in modern times (McCrone 1988; McCrone and McCrone 1974; Washburn 1971). Both of these "proofs" of forgery have been discredited by subsequent research (Cahill et al. 1985, 1987; Painter 1995; Olin 2003; Weaver 1976). We discussed the possible relevance of our ^{14}C date of AD 1434 ± 11 to the authenticity question in our paper (Donahue et al. 2002:50–51). We can summarize it by saying that it seems highly unlikely that a forger would get a parchment of *exactly* the right ^{14}C date, i.e. agreeing with all the other evidence for authenticity, not knowing what that date was going to be when the forgery was executed, and probably unaware of the then far-in-the-future capability of ^{14}C dating.

In this context, the purpose of this letter is to respond to Ambers and Bowman by discussing what the presence of the bomb-labeled material, about 30% of our parchment sampling, implies for the history of the Vinland Map. I believe that as a result of the measurement and Ambers and Bowman's (2002) suggestions we can now see certain observations begin to fall into place.

Many observers and students of the Vinland Map have commented on its present odd appearance, usually characterized as "washed-out." Baynes-Cope (1974:209) says on the basis of his 1967 examination of the map, that "the drawing is very faded, and the parchment has a 'washed-out' appearance, suggesting that it may have been chemically treated in some way" and "it was . . . clear that it had received treatment, almost certainly of a rather drastic nature." Seaver (2004:171) recounts the testimony of several experts, for example D B Quinn, who was "troubled . . . by the indications of an attempted cleaning, which might well be responsible for the washed-out appearance of the map's parchment." She concludes that "the map's parchment . . . clearly underwent fairly traumatic treatment at one point" (Seaver 2004:169). Painter says: "During this turn-of-the-century rebinding the map was washed and cleaned from almost five centuries of soiling" (1995:xvi). Other

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observers mention the odd, atypical fluorescence of the map under ultraviolet excitation (Baynes-Cope 1974; Cahill et al. 1985:4), and I believe that Ambers and Bowman (2002) are right on the mark to explain this "by the presence of organic materials on the surface of the parchment." They cogently add: "It could, of course, be equally argued that the presence of a large quantity of modern material might be the result of rather clumsy conservation treatment applied at the time of the first discovery of the piece . . . " (Ambers and Bowman 2002).

If, as seems very likely, the map *was* washed and treated, an obvious corollary that has escaped most commentators and students, is that observers have actually been studying the map in its laundered, treated, and thus necessarily much-altered state, and of course basing their conclusions on their examination of the map *in that state*. This is particularly important to high-tech laboratory examinations: for example, one could ask, Of what value were McCrone's micron-sized particle identifications and anatase-size distributions when a tsunami of prior conservation treatment had already washed over the document and its ink?

The labeling of the "substance" by bomb ^{14}C gives us a handle on the date of this cleaning and/or conservation that involved the treatment of the map with something that may have been used as a fixative to make the map's flaking ink adhere more firmly. Ambers and Bowman suggest a number of substances, including cellulose nitrate, and Margaret Lawson, a parchment/paper conservator at the Metropolitan Museum of Art recently made the same suggestion (Lawson, personal communication), referring me to the classic textbook of Plenderleith and Werner (1971). Cellulose nitrate or acetate would indeed possess the observed properties: they would contain atmospheric excess ^{14}C introduced through the cellulose component, would persist through ~50 yr on a parchment lying open to the air, are very soluble in acetone, and were used with medieval parchment during this period (1950s). I shall say more about some unpleasant implications that this "treatment" would have, below.

When did it happen? The lower limit to the date is of course the start of thermonuclear testing in 1952, because only after that date does excess ^{14}C begin to appear, and atmospheric "fractions of modern" begin slowly to rise above 1.00 (CALIBomb: http://calib.qub.ac.uk/CALIBomb/frameset.html; Baxter et al. 1969). Actually, the rise in ^{14}C due to the bomb tests does not become pronounced enough to explain the level in the parchment until the Russian Novaya Zemlya "Tsar-bomba" 50-megaton shot in 1954, after which time it begins to rise more rapidly (Baxter et al. 1969; CALIBomb). On the other hand, the date of the treatment cannot have been later than 1957, because after that date the Vinland Map goes to Yale, and we understand from their records in the Beinecke Library catalog entry for the map, 350A (Shailor 1987), that no such conservation occurred there. Thus, for the possible date of "treatment" we are crowded into a narrow date range of only 3 or 4 yr immediately preceding the map's arrival in New Haven. It would seem that during most of this period, the Vinland Map-Tartar Relation volume was in the hands of Ferrajoli (Seaver 2004:116). If the "conservation treatment" was, as Ambers and Bowman suggest, "clumsy," it is hard to imagine it being inflicted on the Vinland Map by an experienced antique book dealer like Rauch or Davis (Witten 1971). Besides, the map was not theirs to bleach; only Ferrajoli could have been responsible, in my opinion. The identity of the restorer is not important to my argument.

Can we infer something about the probable treatment? Indeed, we can. Plenderleith and Werner (1971) give us this strong hint, after describing how an application of sodium hypochlorite is used as a bleach to clean soiled manuscripts (just what an itinerant map-seller in the 1950s might do to make his difficult-to-sell wares more attractive to dealers and buyers): "During the bleaching process any iron-gall inks will disappear unless protected beforehand. This is done while the paper is still dry, by a local application of a solution of nitrocellulose 5% in a mixed solvent of equal volumes

of acetone and amyl acetate. The nitrocellulose can be removed by a wash of acetone at the conclusion of operations." Use of a hypochlorite bleach step would surely account for the almost-universal observation that the map has a "bleached look," and our work (Donahue et al. 2002) confirms that the unknown substance is readily removed by acetone.

Considering the nature of the rebinding, which has been described as amateurish or "undistinguished" (Parker 1971:20) and "not a very professional job" (Greenfield 1983), it is not difficult to imagine that the Ferrajoli restorers also failed to remove the nitrocellulose, or whatever it was that was used to protect the map during the bleach, at the end. Or perhaps they felt that it should be left in the better to secure the ink from flaking. The hypochlorite is supposedly washed out with pure water rinses, according to Plenderleith and Werner, and one cannot but wonder if the chlorine found on the manuscript of the Vinland Map by PIXE (Cahill et al. 1985, 1987) reflects the residue from a bleaching operation.

The implication of our work is that the dismantling, washing, treatment, and rebinding were all done sometime during 1952–1957, with a slight preference for 1954–1957, by someone other than a professional conservator or a first-line dealer in antique books (Seaver 2004:116). This was, of course, just when Ferrajoli was peddling the map around Europe. This date would also fit with several observers' estimation of a post-World War II date for the physical binding (Parker 1971; Baynes-Cope 1989; Greenfield 1983). Regarding the binding, Baynes-Cope (1989) notes that "the tail-band was formed . . . on a bright pink mono filament . . . in a form which I remember appearing in the U.K. c.a. [*sic*] 1946–7."

Let me conclude this letter with a note of concern directed to Yale's Beinecke Library. It is imperative from the conservation standpoint to identify what you have permeating your Vinland Map. If it indeed proves to be cellulose nitrate ("nitrocellulose" or "guncotton"), then it is chemically unstable. The pure substance is, of course, highly explosive and while I am not sure that a 30% nitrocellulose-70% parchment mix would actually detonate, I do feel pretty certain that it would be *highly inflammable*. Therefore, I would respectfully suggest that, to be on the safe side, you allow no more laser probes of the Vinland Map as in the measurements of Brown and Clark (2002) until you can identify this unknown substance. A laser spot, though small, could raise the local temperature to the point where damage is readily observable, perhaps with accompanying photolytic reactions (De Jesus et al. 2003), or in the worst case, trigger combustion. After all these years it would be a pity to see the Vinland Map (Skelton et al. 1995) damaged in any way.

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