DALTON
LETTER

Organosilicon compounds — a comment on nomenclature usage. Letter and reply

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Letter

There has been considerable media interest in issue 3 of this years *Journal of the Chemical Society*, *Dalton Transactions*. I had recently read[1] a pre-disclosure concerning the work by Kinrade *et al.* detailing the first spectroscopic evidence (^{29}Si NMR) for the formation of an organosilicon complex during the life cycle of a simple diatomic organism.[2] The media title: "First Carbon–Silicon Compound Discovered in a Life Form" stuck in my mind immediately. Upon reading this manuscript, it became evident that what the authors intended to convey was that they had unprecedented evidence for a transient Si–N (azo) complex that contains organic groups that are believed to be bonded to this *nitrogen* but not to silicon. Recently, media attention of this result has been extensive but unfortunately the phrase "organosilicon", which admittedly only appears in the abstract and text, has been misused and unfortunately distracts from the theme and implications of the work presented.

The type of silicon complex observed by the authors is described as: ". . .an organosilicon complex containing hexavalent silicon coordinated to at least one nitrogen".[2] Further to this, their evidence suggests the other atoms bonded to silicon are likely oxygen. Related to this observation are suitable citations of the authors own work on, for example, hexavalent siloxy complexes of aliphatic sugar acids.[3] Although the authors have also referred to these species as "organosilicon" in nature, there are no Si–C bonds in these compounds either. Since the term "organosilicon" clearly implies the presence of a Si–C bond, this statement is erroneous and unfortunately downplays the highly novel and very intriguing results disclosed in this most recent manuscript.[2]

In Eaborn's classic 1960 textbook on the organic chemistry of silicon,[4] the definition of an organosilicon compound is clearly stated:

"An organosilicon compound is one containing at least one organic group attached to silicon *directly through carbon*. This definition includes such compounds as CH_3SiH_3, $C_2H_5SiCl_3$ and Cl_3CSiCl_3, but excludes such compounds as SiC, H_3SiCN, $Si(OCH_3)_4$ and $H_3SiSC_2H_5$."

Since that time (and previous to it in fact), this definition of the phrase "organosilicon" has come to be the accepted one. By the same token, this is why, for example, we do not refer to tris(phenanthroline)cobalt(III) chloride as an "organometallic" or "organocobalt" complex. Although this compound clearly contains carbon and a (transition) metal, it contains no Co–C bonds and hence is called a "coordination compound". I believe that as scientists, we must be very careful about the use of this kind of nomenclature, especially in light of the current explosive growth of chemical literature. In addition to this, there are also a large number of authors who are now presenting their work in English, even though this is not their first language. Phrases such as "organosilicon" are part of that plethora of "buzzwords" we, as chemists, use daily to imply specific aspects of structure and bonding. If we begin to use these terms flippantly, the meaning of such phrases and their chemical consequences will quickly become blurred. Since these recent results[2] have justifiably become a news item, it is vital that (non-chemical) scientists and members of the general public are given clear definitions of what the work means in chemical terms.

Certainly, the observation *in-vivo* of transient silicon compounds being acquired and then degraded by simple biological organisms is highly novel and very intriguing, but there is not any direct evidence to suggest that Si–C bonds are involved in these materials. Perhaps it would be more prudent to simply suggest that "silicon compounds which appear to also contain carbon" are involved. This would be a clearer and more precise definition. As a result, it is far less likely to be misinterpreted by novice (or non-chemical) scientists or members of the general public that read these publications and/or the news items derived from them.

Reply

Professor Gossage is absolutely right, and his helpful comments are well taken. We had no intention of implying the existence of a complex containing a Si–C bond; and indeed, as Professor Gossage correctly surmised, we present evidence of a molecule that contains Si–O–C linkages and, very possibly, direct Si–N coordination. We are grateful to him for raising the issue, and thereby allowing us the opportunity to clarify this point. Our complex should properly be referred to as an 'organosilicate'. His suggestion that we describe such species as "silicon compounds which appear to also contain carbon" also seems appropriate.

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References

1 In my case, reference to this manuscript was highlighted on the internet chemistry server "chemweb", specifically at URL: www.chemweb.com/alchem/articles/1010599173933.html.

2 S. D. Kinrade, A.-M. E. Gillson and C. T. G. Knight, *J. Chem. Soc., Dalton Trans.*, 2002, 307.

3 For example: S. D. Kinrade, R. J. Hamilton, A. S. Schach and C. T. G. Knight, *J. Chem. Soc., Dalton Trans.*, 2001, 961.

4 C. Eaborn, *Organosilicon Compounds*, Butterworths Scientific Publishers, London, 1960; Similar definitions can also be found in other more recent textbooks such as: D. Shriver and P. Atkins, *Inorganic Chemistry*, Freeman, NY, 3rd edn., 1999, ch. 15, pp. 499–528; F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, *Advanced Inorganic Chemistry*, Wiley, Toronto, 6th edn., 1999, ch. 8, section 8-1, p. 284; J. Claydon, N. Greeves, S. Warren and P. Wothers, *Organic Chemistry*, Oxford University Press, Toronto, 2001, ch. 47, pp. 1277–1304.