

and 12 positions of the carborane icosahedron are not involved in the degradation reaction.

The evidence outlined above suggests that $B_9C_2H_{12}^-$ and $B_9C_2H_{13}$ are icosahedral fragments isoelectronic with the hypothetical $B_{11}H_{12}^{-3}$ and the known³ $B_{11}H_{13}^{-2}$ ions. The removal of a boron atom from the 4, 5, 7, or 11 positions² or from the 3 or 6 positions² is indicated by the kinetic results and hydrogen analysis data. The fact that position isomers are not observed with C-monosubstituted carboranes suggests that the boron atom in position 3 or 6 is removed. This would place the two carbon atoms as near neighbors in the pentagonal face of the assumed icosahedral fragment.

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(3) V. D. Aftandilian, H. C. Miller, G. W. Parshall, and E. L. Muetterties, *Inorg. Chem.*, **1**, 734 (1962).

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The Preparation of 1-[1,2-Dicarbaclvododecaboranyl(12)]- 1,2-dicarbaclvododecaborane(12)

Sir:

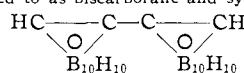
The recent reports of the preparation of icosahedral 1,2-dicarbaclvododecaborane(12) and its derivatives^{1,2} prompt us to report the preparation of 1-[1,2-dicarbaclvododecaboranyl(12)]-1,2-dicarbaclvododecaborane(12)³ and its precursor, 1-ethynyl-1,2-dicarbaclvododecaborane(12).

Treatment of an acetonitrile solution of $B_{10}H_{12}(CH_3CN)_2$ with diacetylene⁴ at the reflux temperature for a period of 5 hr. produced C-ethynylcarborane, 35%, m.p. 75–78° (*Anal.* Calcd. for $B_{10}C_4H_{12}$: B, 64.27; C, 28.54; H, 7.20. Found: B, 62.22; C, 28.70; H, 7.70), and biscarborane(12), 4%, m.p. 309–310° (*Anal.* Calcd. for $B_{20}C_4H_{22}$: B, 74.45; C, 16.53; H, 9.02. Found: B, 75.30; C, 17.50; H, 8.20). Improved yields (ca. 60%) of biscarborane were obtained from C-ethynylcarborane and $B_{10}H_{12}(CH_3CN)_2$

(1) C. C. Clark, U. S. Patent 3,062,756 (Nov. 6, 1962); T. L. Heying, J. W. Ager, Jr., S. L. Clark, D. J. Mangold, H. L. Goldstein, M. Hillman, R. J. Polak, and J. W. Szymanski, *Inorg. Chem.*, **2**, 1089 (1963); H. Schroeder, T. L. Heying, and J. R. Reiner, *ibid.*, **2**, 1092 (1963); T. L. Heying, J. W. Ager, Jr., S. L. Clark, R. P. Alexander, S. Papetti, J. A. Reid, and S. I. Trotz, *ibid.*, **2**, 1097 (1963); S. Papetti and T. L. Heying, *ibid.*, **2**, 1105 (1963); R. P. Alexander and H. Schroeder, *ibid.*, **2**, 1107 (1963); M. M. Fein, J. Bobinski, N. Mayes, N. Schwartz, and M. S. Cohen, *ibid.*, **2**, 1111 (1963); M. M. Fein, D. Grafstein, J. E. Paustian, J. Bobinski, B. M. Lichstein, N. Mayes, N. N. Schwartz, and M. S. Cohen, *ibid.*, **2**, 1115 (1963); D. Grafstein, J. Bobinski, J. Dvorak, H. Smith, N. Schwartz, M. S. Cohen, and M. M. Fein, *ibid.*, **2**, 1120 (1963); D. Grafstein, J. Bobinski, J. Dvorak, J. E. Paustian, H. F. Smith, S. Karlan, C. Vogel, and M. M. Fein, *ibid.*, **2**, 1125 (1963); D. Grafstein and J. Dvorak, *ibid.*, **2**, 1128 (1963).

(2) The nomenclature employed here was recently adopted by the Nomenclature Committee of the Inorganic Division of the American Chemical Society. See R. Adams, *Inorg. Chem.*, **2**, 1087 (1963).

(3) Hereafter referred to as biscarborane and symbolically described by



(4) J. B. Armitage, E. R. H. Jones, and M. C. Whiting, *J. Chem. Soc.*, **44** (1951).

in acetonitrile at the reflux temperature for 16 hr.

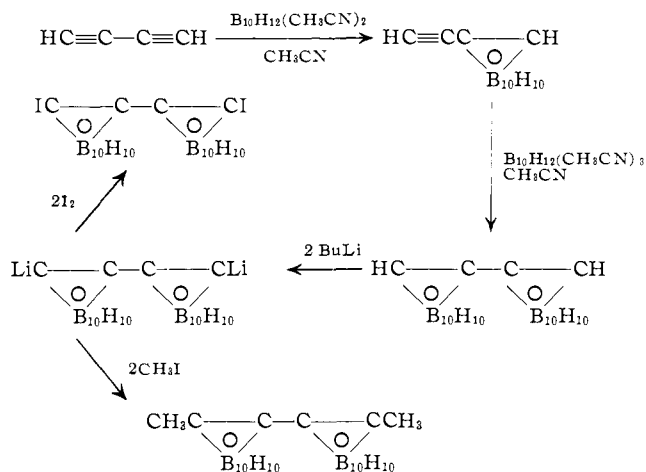
The infrared spectrum of C-ethynylcarborane contained sharp C–H stretching bands at 3.08 and 3.32 μ and a carbon–carbon triple bond stretching band at 4.70 μ . The 3.08 μ C–H band is attributed to the acetylenic C–H.

Treatment of biscarborane with 2 equiv. of butyllithium in diethyl ether solution followed by 2 equiv. of methyl iodide afforded C,C'-dimethylbiscarborane, 90%, m.p. 193–194°. *Anal.* Calcd. for $B_{20}C_6H_{26}$: B, 68.77; C, 22.90; H, 8.33. Found: B, 67.45; C, 22.81; H, 8.83. This alkylation reaction undoubtedly involves the dianion of biscarborane since similar treatment of carborane produces a nucleophilic dianion.¹

When the biscarborane dianion was treated with 2 molecular equivalents of iodine, C,C'-diiodobiscarborane was obtained in low yield, m.p. 183–184°. *Anal.* Calcd. for $B_{20}C_4H_{20}I_2$: B, 40.19; C, 8.92; H, 3.74; I, 47.14. Found: B, 39.70; C, 9.13; H, 3.96; I, 46.36.

These results constitute the first report of a species which is composed of two singly linked icosahedra. The $B_{24}H_{22}^{-2}$ ion, isoelectronic with biscarborane but linked through boron atoms, has not been reported although a $B_{20}H_{15}^{-4}$ probably composed of two singly linked B_{10} polyhedra has been described.⁵

The preparation and reactions of biscarborane(12) are summarized below.



Acknowledgment.—The authors are indebted to Mr. R. Donald Strahm for the analytical data. This research was supported by Contract No. DA-01-021 ORD-5135 with the U. S. Army Ordnance Corps.

(5) M. F. Hawthorne, R. L. Pilling, P. F. Stokely, and P. M. Garrett, *J. Am. Chem. Soc.*, **85**, 3704 (1963).

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Continuity of Bond Force Constants between Normal Molecules and Lennard-Jones Pairs

Sir:

There are a number of striking empirical correlations between bond lengths, force constants, and bond dissociation energies. One of the earliest and most widely