

LITERATURE CITED

- (1) Hawthorne, M. F.; Lee, M. W. A Critical Assessment of Boron Target Compounds for Boron Neutron Capture Therapy. *J. Neurooncol.* **62** (1-2), 33–45.
- (2) Hawthorne, M. F.; Shelly, K.; Li, F. The Versatile Chemistry of the $[B_{20}H_{18}]^{2-}$ Ions: Novel Reactions and Structural Motifs. *Chem. Commun.* **2002**, No. 6, 547–554.
- (3) Barth, R. F.; Vicente, M. G. H.; Harling, O. K.; Kiger, W. S.; Riley, K. J.; Binns, P. J.; Wagner, F. M.; Suzuki, M.; Aihara, T.; Kato, I.; Kawabata, S. Current Status of Boron Neutron Capture Therapy of High Grade Gliomas and Recurrent Head and Neck Cancer. *Radiat. Oncol.* **2012**, *7* (1), 146.
- (4) Feakes, D. A.; Shelly, K.; Knobler, C. B.; Hawthorne, M. F. $Na_3[B_{20}H_{17}NH_3]$: Synthesis and Liposomal Delivery to Murine Tumors. *Proc. Natl. Acad. Sci. U. S. A.* **1994**, *91* (8), 3029–3033.
- (5) Shelly, K.; Feakes, D. A.; Hawthorne, M. F.; Schmidt, P. G.; Krisch, T. A.; Bauer, W. F. Model Studies Directed toward the Boron Neutron-Capture Therapy of Cancer: Boron Delivery to Murine Tumors with Liposomes. *Proc. Natl. Acad. Sci. U. S. A.* **1992**, *89* (19), 9039–9043.
- (6) Feakes, D. A.; Waller, R. C.; Hathaway, D. K.; Morton, V. S. Synthesis and *in Vivo* Murine Evaluation of $Na_4[1-(1'-B_{10}H_9)-6-SHB_{10}H_8]$ as a Potential Agent for Boron Neutron Capture Therapy. *Proc. Natl. Acad. Sci. U. S. A.* **1999**, *96* (11), 6406–6410.
- (7) Greenwood, N.N., Earnshaw, A. *Chemistry of Elements* 1st ed.; Emsford: Ney York, 1986; pp 155-202
- (8) Welch, A. J. The Significance and Impact of Wade's Rules. *Chem. Commun. (Camb).* **2013**, *49* (35), 3615–3616.
- (9) Kroto, H. W.; Heath, J. R.; O'Brien, S. C.; Curl, R. F.; Smalley, R. E. C₆₀: Buckminsterfullerene. *Nature* **1985**, *318* (6042), 162–163.
- (10) Wade, K. The Structural Significance of the Number of Skeletal Bonding Electron-Pairs in Carboranes, the Higher Boranes and Borane Anions, and Various Transition-Metal Carbonyl Cluster Compounds. *J. Chem. Soc. D Chem. Commun.* **1971**, No. 15, 792.
- (11) Mingos, D. M. P. A General Theory for Cluster and Ring Compounds of the Main Group and Transition Elements. *Nature* **1972**, *236* (68), 99–102.

- (12) Lipscomb, W. N. The Boranes and Their Relatives. *Science* **1977**, *196* (4294), 1047–1055.
- (13) Johnson, W. C. Hydrides of Boron and Silicon (Stock, Alfred). *J. Chem. Educ.* **1934**, *11* (4), 256.
- (14) Stock, A. *Hydrides of Boron and Silicon*. Cornell University Press: Ithaca, NY, **1933**
- (15) Kaczmarczyk, A.; Dobrott R. D., and Lipscomb, W. N. Reactions of $[B_{20}H_{18}]^{2-}$ Ion. *Proc. Natl. Acad. Sci.* **1962**, *48*, 729-733.
- (16) Pitochelli, A. R.; Lipscomb, W. N.; Hawthorne, M. F. Isomers of $B_{20}H_{18}^{2-}$. *J. Am. Chem. Soc.* **1962**, *84* (15), 3026–3027.
- (17) Hawthorne, M. F.; Pilling, R. L.; Stokely, P. F. The Preparation and Rearrangement of the Three Isomeric $B_{20}H_{18}^{4-}$ Ions. *J. Am. Chem. Soc.* **1965**, *87* (9), 1893–1899.
- (18) Li, F.; Shelly, K.; Knobler, C. B.; Hawthorne, M. F. A New Isomer of the $[B_{20}H_{18}]^{2-}$ Ion: Synthesis, Structure, and Reactivity of *cis*- $[B_{20}H_{18}]^{2-}$ and *cis*- $[B_{20}H_{17}NH_3]^-$. *Angew. Chemie Int. Ed.* **1998**, *37* (13-14), 1868–1871.
- (19) Hawthorne, M. F.; Pilling, R. L. Photoisomerization of the $B_{20}H_{18}^{2-}$ Ion. *J. Am. Chem. Soc.* **1966**, *88* (16), 3873–3874.
- (20) Hawthorne, M. F.; Pilling, R. L.; Stokely, P. F.; Garrett, P. M. The Isolation and Characterization of $B_{20}H_{19}^{3-}$ and $B_{20}H_{18}^{4-}$ Ions. *J. Am. Chem. Soc.* **1963**, *85* (22), 3704–3705.
- (21) Hawthorne, M. F.; Philling, R. L.; Garrett, P. M. A Study of the Reaction of Hydroxide Ion with $B_{20}H_{18}^{2-}$. *J. Am. Chem. Soc.* **1965**, *87* (21), 4740–4746.
- (22) Watson-Clark, R. A.; Hawthorne, M. F. An Exploratory Evaluation of the Reactions of Organic Oxidants with Polyhedral Borane Anions. *Inorg. Chem.* **1997**, *36* (23), 5419–5420.
- (23) Chamberland BL, Muetterties EL. *Inorg. Chem.* **1964**; *3*: 1451
- (24) Hawthorne, M. F. The Role of Chemistry in the Development of Boron Neutron Capture Therapy of Cancer. *Angew. Chemie Int. Ed. English* **1993**, *32* (7), 950–984.
- (25) Soloway, A. H.; Tjarks, W.; Barnum, B. A.; Rong, F. G.; Barth, R. F.; Codogni, I. M.; and Wilson, J. G. The Chemistry of Neutron Capture Therapy. *Chem. Rev.* **1998**, *98* (4), 1515-1562.

- (26) Georgiev, E. M.; Shelly, K.; Feakes, D. A.; Kuniyoshi, J.; Romano, S.; Hawthorne, M. F. Synthesis of Amine Derivatives of the Polyhedral Borane Anion $[B_{20}H_{18}]^{4-}$. *Inorg. Chem.* **1996**, *35* (19), 5412–5416.
- (27) Smits, J. P.; Mustachio, N.; Newell, B.; Feakes, D. A. Synthesis and Investigation of $[B_{20}H_{17}O(CH_2)_5]^{3-}$, a Novel Solvent Complex of the $[B_{20}H_{18}]^{4-}$ Ion. *Inorg. Chem.* **2012**, *51* (15), 8468–8472.
- (28) Mantz, M. M.S. Thesis, Texas Reactivity of the $[B_{20}H_{18}]^{2-}$ Ion with Carbon Nucleophiles For Potential Application In BNCT Texas State University, **2013**.
- (29) Li, F.; Shelly, K.; Kane, R. R.; Knobler, C. B.; Hawthorne, M. F. ChemInform Abstract: Synthesis and Structure of the Polyhedral $(\mu-B_{20}H_{17}OH)^{2-}$ Borane Anion Containing Both Oxygen- and Hydrogen-Bridge Bonds. *ChemInform* **2010**, *27* (44), no – no.
- (30) Stasko, D.; Hoffmann, S. P.; Kim, K.-C.; Fackler, N. L. P.; Larsen, A. S.; Drovetskaya, T.; Tham, F. S.; Reed, C. A.; Rickard, C. E. F.; Boyd, P. D. W.; Stoyanov, E. S. Molecular Structure of the Solvated Proton in Isolated Salts. Short, Strong, Low Barrier (SSLB) H-Bonds. *J. Am. Chem. Soc.* **2002**, *124* (46), 13869–13876.
- (31) Kato, T.; Stoyanov, E.; Geier, J.; Grützmacher, H.; Reed, C. A. Alkylating Agents Stronger than Alkyl Triflates. *J. Am. Chem. Soc.* **2004**, *126* (39), 12451–12457.
- (32) Montalvo, S. J.; Hudnall, T. W.; Feakes, D. A. Exploring the Redox Reactivity of the $[B_{20}H_{18}]^{2-}$ Ion with Carbon-Based Nucleophiles and Electrophiles. *J. Organomet. Chem.* **2015**.
- (33) Rosenbaum, A. J.; Juers, D. H.; Juhasz, M. A. Copper-Promoted Cyanation of a Boron Cluster: Synthesis, X-Ray Structure, and Reactivity of 12-CN-*closo*- $CHB_{11}H_{10}^-$. *Inorg. Chem.* **2013**, *52* (19), 10717–10719.
- (34) Spielvogel, B. F.; Wojnowich, L.; Das, M. K.; McPhail, A. T.; Hargrave, K. D. Letter: Boron Analogues of Amino Acids. Synthesis and Biological Activity of Boron Analogues of Betaine. *J. Am. Chem. Soc.* **1976**, *98* (18), 5702–5703.

- (35) McVey, W. J.; Matthews, B.; Motley, D. M.; Linse, K. D.; Blass, D. P.; Booth, R. E.; Feakes, D. A. Investigation of the Interactions of Polyhedral Borane Anions with Serum Albumins. *J. Inorg. Biochem.* **2008**, *102* (4), 943–951.
- (36) Yang, N.-C. C.; Libman, J. Ozonation of Acetylenes and Related Compounds in the Presence of Tetracyanoethylene and Pinacolone. *J. Org. Chem.* **1974**, *39* (12), 1782–1784.

Vitae

Sedriel Jose Montalvo was born in Houston, Texas on March 2nd 1988. He began undergraduate studies at Texas State University-San Marcos in 2007, graduating with a Bachelors of Science in Biochemistry in 2013. In 2013, he began Graduate School and performed research under the supervision of Dr. Debra A Feakes. He fulfilled the requirements for a Masters of Science in Chemistry in July 2015. In 2015, he accepted a position as Lecturer at Texas State University for the 2015-2016 academic year.

Permanent address

137 Seascape Dr.

Port Lavaca, Tx 77979

This thesis was typed by Sedriel J Montalvo.