Preface

Bismuth in synthesis: an emerging area

These are exciting times for organic synthesis using green metals. During the last decade, the chemical community finally began considering the previously underused chemistry of organobismuth derivatives and bismuth catalysts. Today, many academic groups around the world are entering the area.

The roots of this field date back to the early 1850's with Löwig's studies of the synthesis of organic derivatives of bismuth, followed by Michaelis' in the late 1880's. Further studies by Gilman in the late 1930's and early 1940's, involving the synthesis of triaryl derivatives of bismuth, were inspired by the seminal work of Michaelis. Wittig in the 1950's also worked on the synthesis of pentaaryl derivatives of bismuth. This line of research was subsequently continued by Sir Barton in the 1980–90's reporting efficient phenylation reactions using triarylbismuth [(III) and (V)] compounds. Further studies by Suzuki involved the synthesis of organobismuth(V) derivatives and bismuthonium salts. In 2006–2007, Mukaiyama demonstrated the utility of organobismuth(V) derivatives as very efficient reagents for various phenylations and oxidations.

The role of bismuth(III) salts as Lewis acids has only been studied since the late 1980's. Pioneering work by Dubac, Wada and others paved the way to wide and general methods using bismuth(III) catalysts. The versatile use of bismuth salts in synthesis has clearly been highlighted by the increasing number of publications in the field. The low toxicity of bismuth salts, associated with low cost, make them attractive and practical catalysts to use. Synergistic effects with other Lewis acids have also been recently highlighted.

The discovery that some bismuth salts could be used as Lewis acids in aqueous conditions finally opened the door to designing catalysts and to broadening the concept of hydrocompatible Lewis acids, which has since been applied to various reaction types.

Moreover, the use of bismuth catalysts has definitively contributed to the area of environmentally benign catalysts, known as green catalysts. These are fascinating

developments since such green catalysts are now widely appreciated and new reactions and catalysts are being designed and published on a regular basis.

The current developments allow us to demonstrate that bismuth chemistry truly is an emerging field. Efficient catalytic transformations using bismuth are definitively high potential processes, which encompass asymmetric catalysis using chiral bismuth(III) complexes as one of their most promising challenges to reach. The expanding activity in the field and the resulting constant need for knowledge developments make this volume an essential update in organic synthesis using bismuth.

Both areas of bismuth chemistry – organobismuth derivatives and the use of bismuth salts as catalysts – are covered in this volume, providing an overview of the field from experts in their respective areas. I would like to wholeheartedly thank all those who have contributed to making this volume such a wonderful and original source of knowledge. I hope it will inspire you to apply new methods using bismuth derivatives to solve some of your specific problems, but possibly also contribute to meeting some of the remaining challenges of synthetic organic chemistry.

Québec, Winter 2011 Thierry Ollevier