RHODIUM-CATALYSED (3+1+2) CYCLOADDITIONS OF ELECTRON-POOR CYCLOPROPANES

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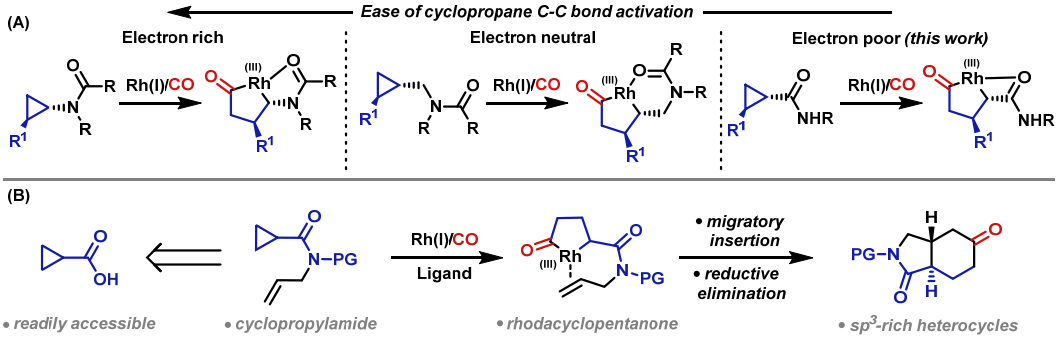
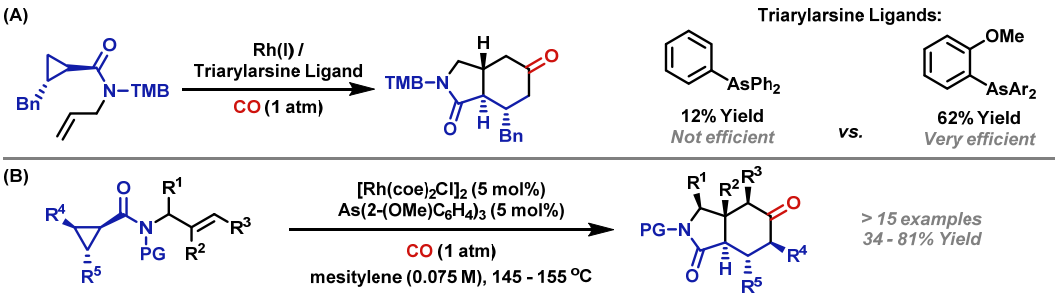
The Bower group has developed a strategy for the regioselective carbonylative C-C bond activation of electron rich and electron neutral cyclopropanes bearing suitable N-directing groups (Scheme 1A) [1,2]. C-C bond activation of simple and readily accessible electron-poor cyclopropanes, however, is deceptively challenging. To address this, I have developed methodology for amide-directed formation of rhodacyclopentanones from cyclopropylamides (Scheme 1B) [3]. Subsequent migratory insertion of tethered alkenes into these intermediates enables access to sp^3-rich heterocycles with high atom economy (Scheme 1B).



Scheme 1 – Introduction

The reaction scope, as well as key mechanistic and synthetic considerations of this new process will be outlined. Substitution on the cyclopropane unit made C-C oxidative addition more challenging, thus a library of fifteen triarylarsine ligands was prepared in order to optimise this process (Scheme 2A). Ultimately, I found that $As(2\text{-}(OMe)C_6H_4)_3$ enabled the cycloaddition in Scheme 2A to proceed with good levels of chemical efficiency. A range of substrates were tolerated, affording stereochemically complex structures in good yields (Scheme 2B).



Scheme 2 – Ligand design and substrate scope (*ACIE, 2019*)

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[1] a) M. H. Shaw, E. Y. Melikhova, D. P. Kloer, W. G. Whittingham and J. F. Bower, *J. Am. Chem. Soc.* **2013**, *135*, 4992; b) M. H. Shaw, N. G. McCreanor, W. G. Whittingham and J. F. Bower, *J. Am. Chem. Soc.* **2015**, *137*, 463.

[2] a) G.-W. Wang, N. G. McCreanor, M. H. Shaw, W. G. Whittingham and J. F. Bower, *J. Am. Chem. Soc*, **2016**, *138*, 13501; b) For a review, see: A. G. Dalling and J. F. Bower, *Chimia* **2018**, *72*, 595.

[3] A. G. Dalling, T. Yamauchi, N. G. McCreanor, L. Cox and J. F. Bower, *Angew. Chem. Int. Ed.* **2019**, *58*, 221.