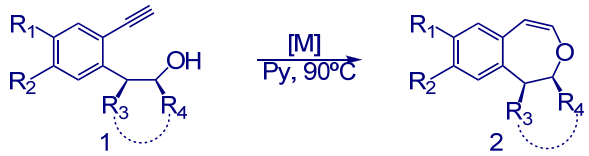
Regioselective 7-*endo* Heterocyclizations via Catalytic Ru- and Os-vinylidenes: Formation of 3-Benzoxepines

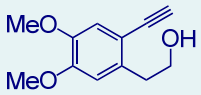
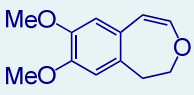
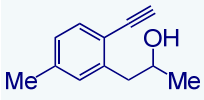
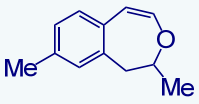
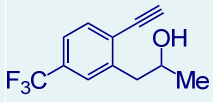
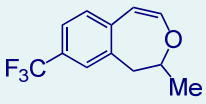
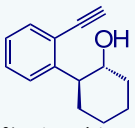
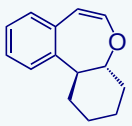
Jesús A. Varela, Alejandro Varela-Fernández, Carlos González-Rodríguez, Carlos Saá
Departamento de Química Orgánica, Facultad de Química, Universidad de Santiago de Compostela
15782 Santiago de Compostela, Spain. Email: jesus.varela@usc.es; carlos.saa@usc.es

Regioselective 7-*endo* Heterocyclization of Aromatic Alkynols via Catalytic Ru- and Os-vinylidenes

The development of effective strategies for the synthesis of heterocyclic compounds is a very important challenge for modern organic synthesis.[1] The involvement of catalytic metal vinylidenes represents a relatively new and attractive approach towards this end.[2] Herein we present a new Ru- and Os-catalyzed 7-*endo* cyclization of aromatic alkynols **1** to give 3-benzoxepines **2** in quite good yields.



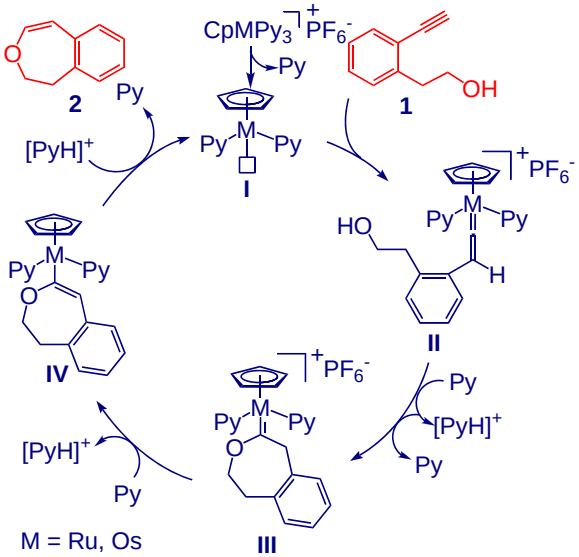
[M] = $[CpRu(CH_3CN)_3]PF_6$, $[CpOs(Py)_3]PF_6$

Entry	Substrate	Product	[Ru][a] %	[Ru][a] h	[Os][b] %	[Os][b] h
1			28	5	60	0.5
2			31	1	68	1
3			29	1	63	0.5
4			32	4	56	1.5

[a] *Typical conditions*: 1 0% $[CpRu(CH_3CN)_3]PF_6$, 0.15M, Py, 90°C. [b]10% $[CpOs(py)_3]PF_6$, 0.15M, Py, 90°C.

Proposed Catalytic Cycle

After dissociation of pyridine from the cationic $CpML_3$ precatalysts, cationic unsatutated 16 e⁻ M(II) are formed acting as the catalytic species **I**, which coordinate alkynol **1** to give vinylidenes **II**. Then, the α electrophilic center of the vinylidenes undergo intramolecular attack by the alcohol to give the 2-oxocycloalkylidene intermediates **III**, which after deprotonation by pyridine afford alkenyl metals **IV**. Finally, protonation of the heterocyclic ligand with the piridinium liberates the 3-benzoxepine **2** and regenerate the catalytic cationic species **I** .



Agradecimientos: We thank the Spanish MICINN (CTQ2008-06557), Consolider Ingenio 2010 (CSD2007-00006) and the Xunta de Galicia (2007/XA084 and INCITE08PXIB209024PR) for funding. A.V.-F and C.G.-R. thanks the U.S.C. and Xunta de Galicia for a predoctoral and postdoctoral contract, respectively .

Referencias: [1] *Comprehensive Heterocyclic Chemistry III*; Eds. A. R. Katritzky, C. A. Ramsden, E. F. V. Scriven, R. J. K. Taylor; Elsevier, **2008**.
[2] a) Trost, B. M.; McClory, A. *Angew. Chem., Int. Ed.* **2007**, *46*, 2074. b) Trost, B. M.; Frederiksen, M. U.; Rudd, M. T. *Angew. Chem., Int. Ed.* **2005**, *44*, 6630. e) Bruneau, C.; Dixneuf, P. H. *Angew. Chem., Int. Ed.* **2006**, *45*, 2176.