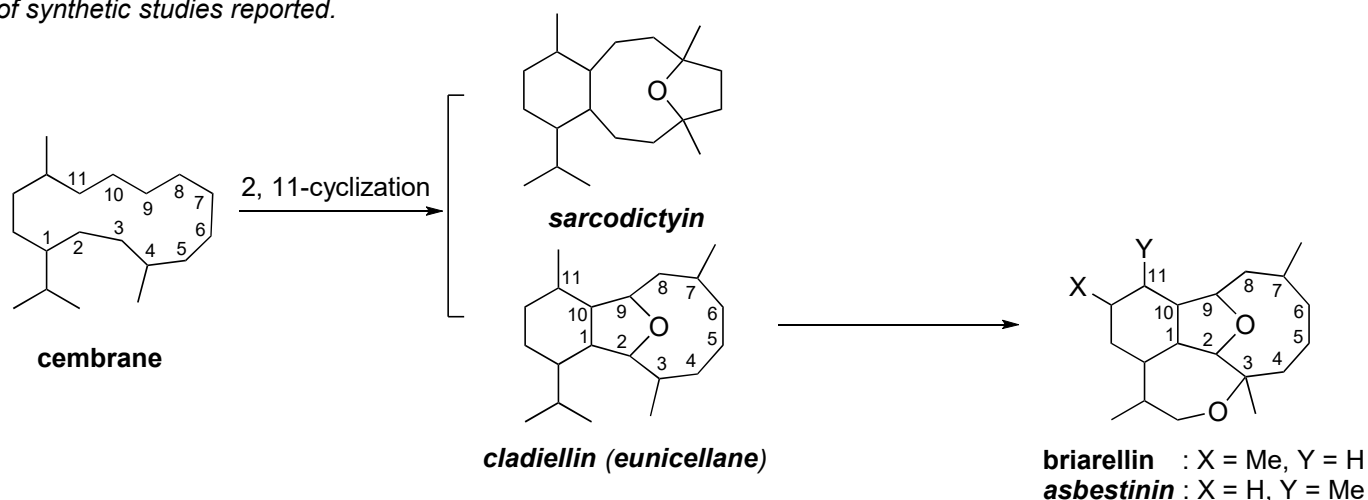


topic: Total Synthesis of marine 2,11-cyclized cembranoids

0. 2,11-cyclized cembranoids

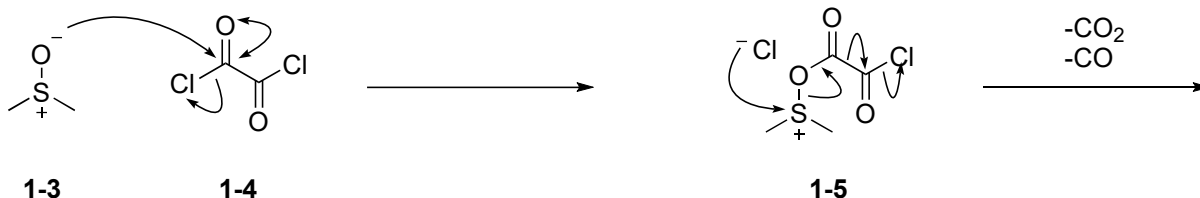
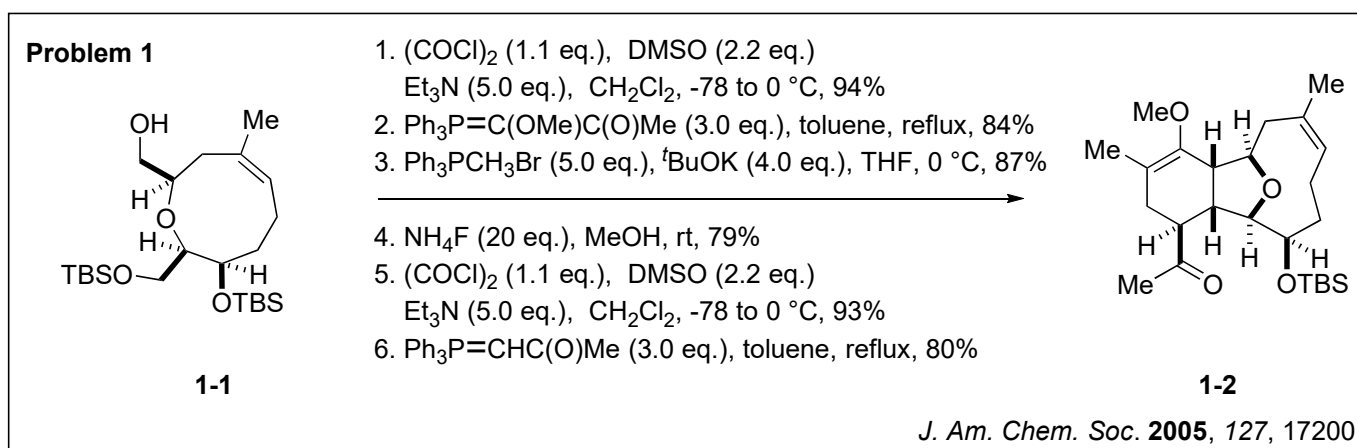
Isolated mainly from marin sponges. common skelton of cembrane, Cladiellins (eunicellane), briarellins, asbestinins and sarcodictyins. Due to the various biological activities of these natural products were known.a lot of synthetic studies reported.

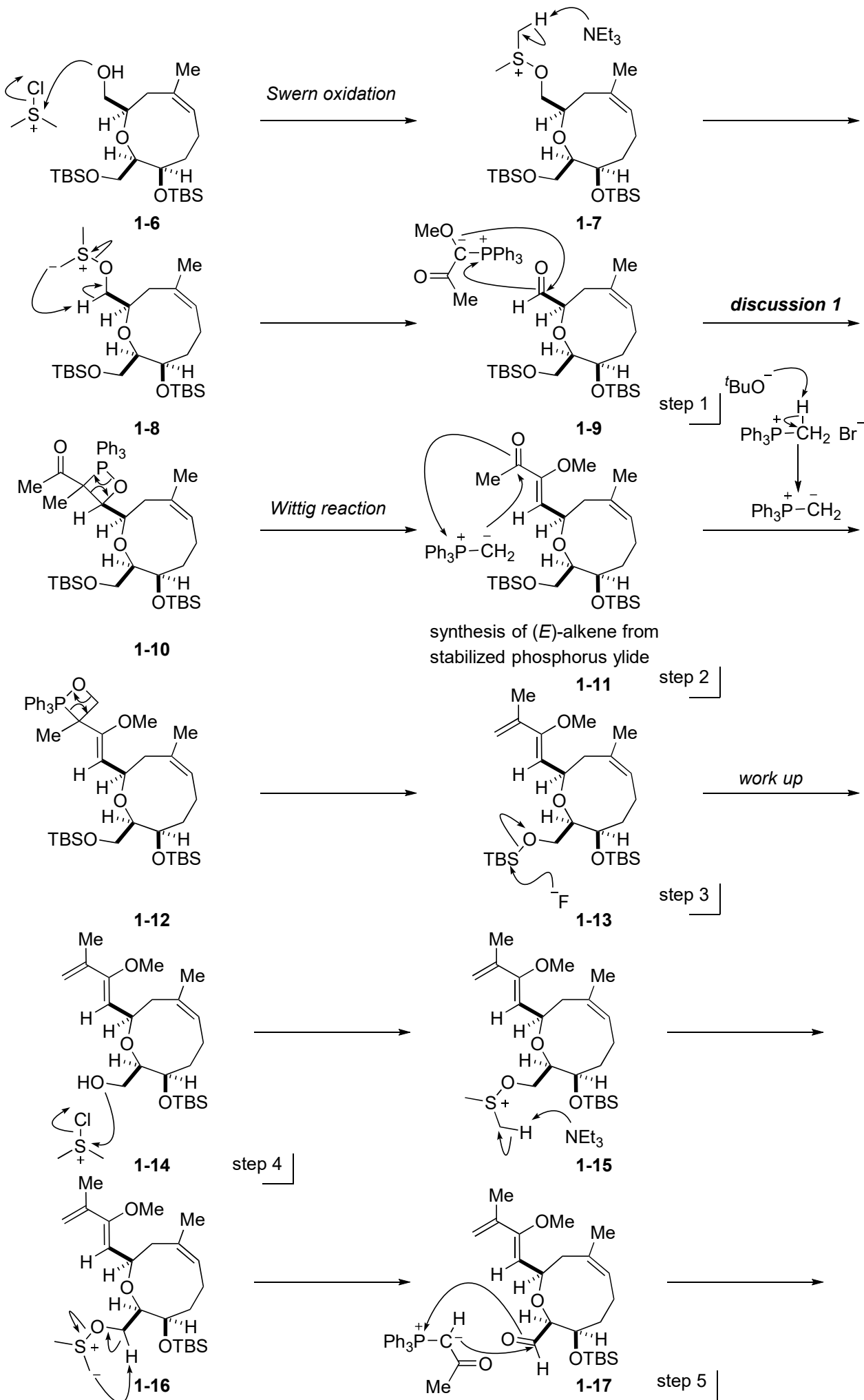


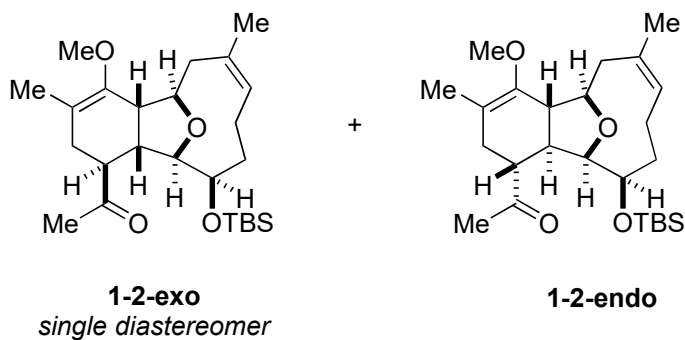
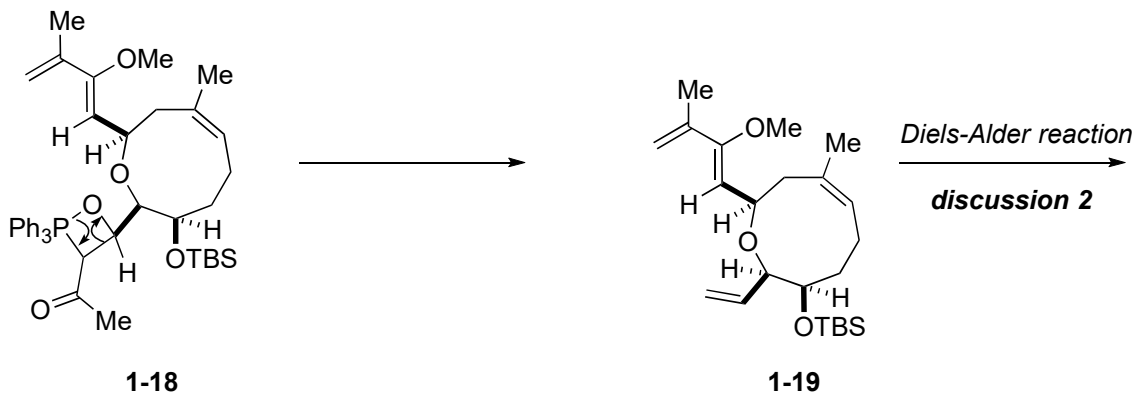
(-)-Deacetoxyalcyonin Acetate:  
*J. Am. Chem. Soc.* **1995**, *117*, 10391 (Overman)  
*J. Am. Chem. Soc.* **2004**, *126*, 1642 (Molander)  
*J. Am. Chem. Soc.* **2006**, *128*, 15851 (Kim)  
 Ophirin B :  
*J. Am. Chem. Soc.* **2004**, *126*, 10264  
 Astrogorgin :  
*J. Am. Chem. Soc.* **2006**, *128*, 1371 (Crimmins)  
 Vigulariol :  
*Angew. Chem. Int. Ed.* **2007**, *46*, 437 (Clark)  
*Angew. Chem. Int. Ed.* **2008**, *74*, 1654 (Hoppe)  
 (+)-Polyanthellin A :  
*J. Am. Chem. Soc.* **2009**, *131*, 10370

Briarellins E, F :  
*J. Am. Chem. Soc.* **2003**, *125*, 6650 (Overman)  
 11-Acetoxy-4-deoxyasbestinin D :  
*J. Am. Chem. Soc.* **2005**, *127*, 17200  
 (Crimmins) **Problem 1**

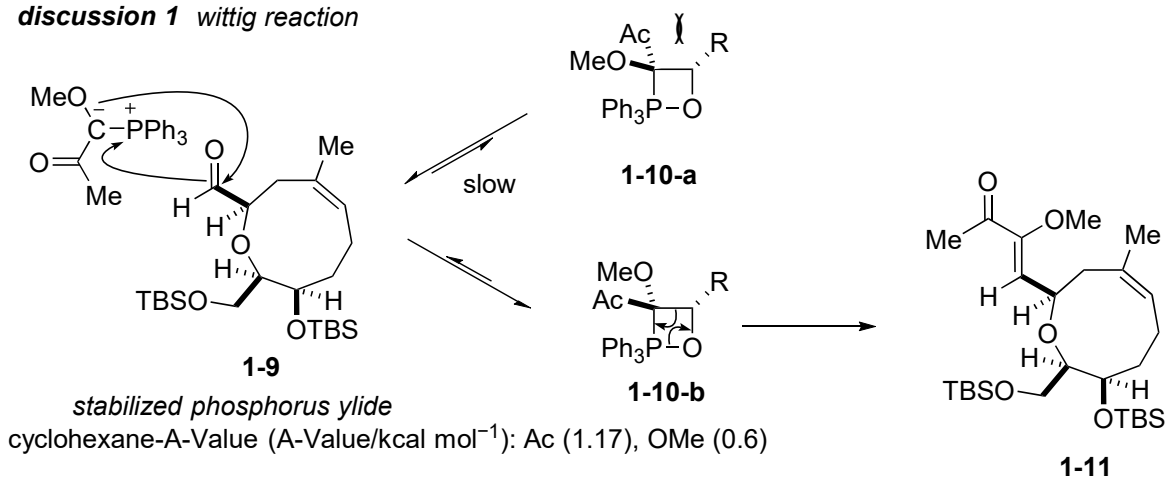
Answer :



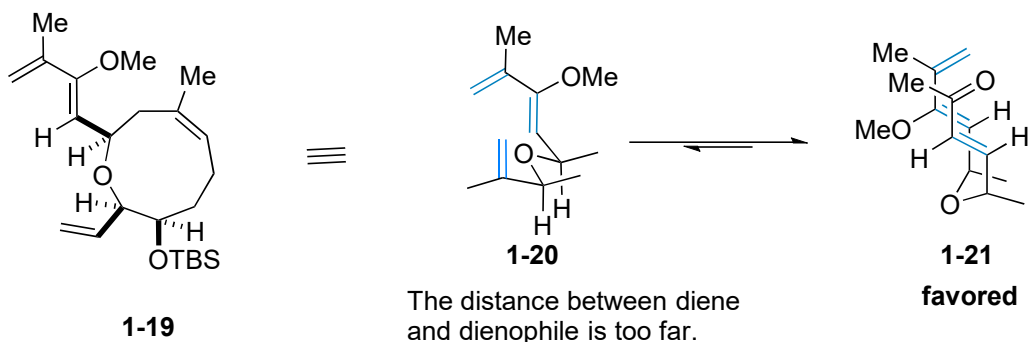


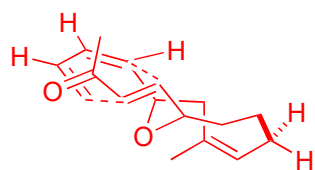


**discussion 1** *wittig reaction*

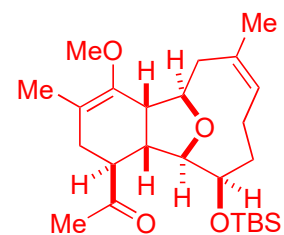


**discussion 2** *Diels-Alder reaction*

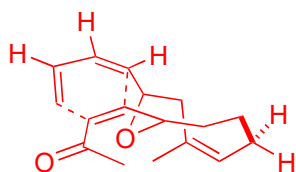




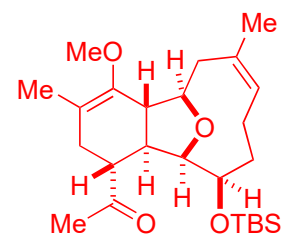
**TS-1-2-exo**



**1-2-exo**  
single diastereomer

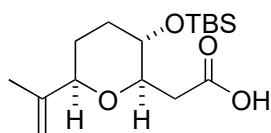


**TS-1-2-endo**



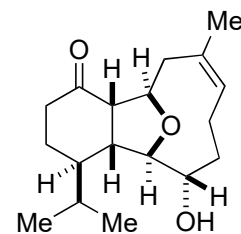
**1-2-endo**

**Problem 2**



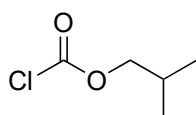
**2-1**

1. IBCF (1.2 eq.), Et<sub>3</sub>N (1.3 eq.), Et<sub>2</sub>O, rt  
then CH<sub>2</sub>N<sub>2</sub> (4.0 eq.), Et<sub>2</sub>O, 0 °C to rt, 88%
2. Cu(hfa)<sub>2</sub> (2 mol%), CH<sub>2</sub>Cl<sub>2</sub>, rt, 94% (**Z** : **E** = **5.9** : **1**)
3. NaHMDS (2.5 eq.), PhN(Tf)<sub>2</sub> (2.0 eq.), toluene, -78 °C
4. CH<sub>2</sub>C(OEt)SnBu<sub>3</sub> (3.0 eq.), Pd(PPh<sub>3</sub>)<sub>4</sub> (15 mol%)  
LiCl (3.0 eq.), THF, reflux
5. **A** (10 eq.), toluene, reflux, 69% (3 steps, dr = 2 : 1<sup>a</sup>)
6. Ph<sub>3</sub>PCH<sub>3</sub>Br (2.1 eq.), <sup>t</sup>BuOK (1.7 eq.), THF, 50 °C  
then 1M HCl, 78%
7. H<sub>2</sub>, PtO<sub>2</sub>, EtOAc, rt, 97%

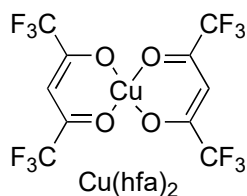


**2-2**

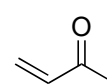
<sup>a</sup> Can be converted to a single isomer under the condition : K<sub>2</sub>CO<sub>3</sub> (1.5 eq.), MeOH, rt



IBCF

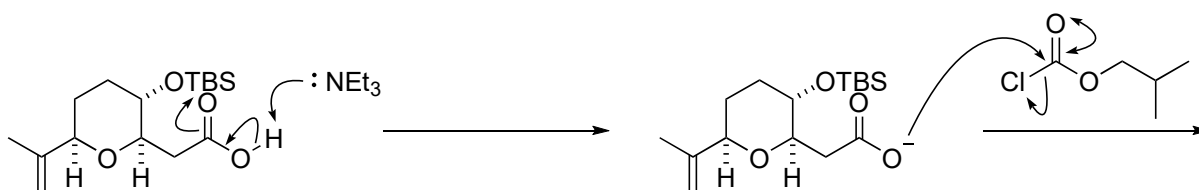


Cu(hfa)<sub>2</sub>



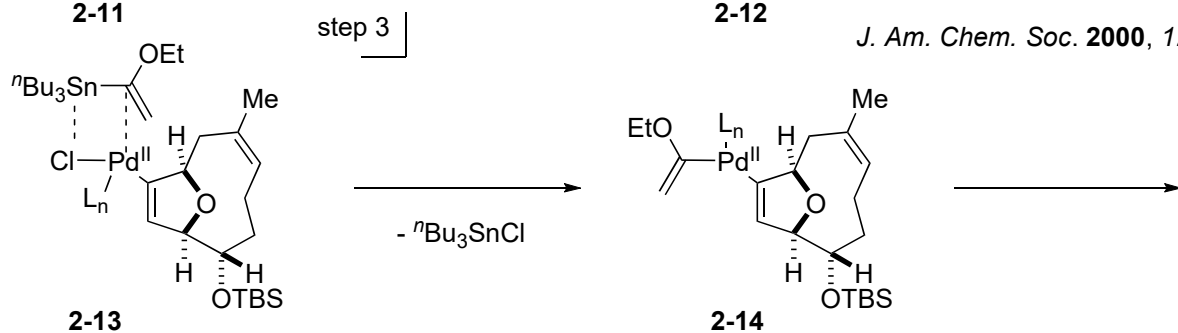
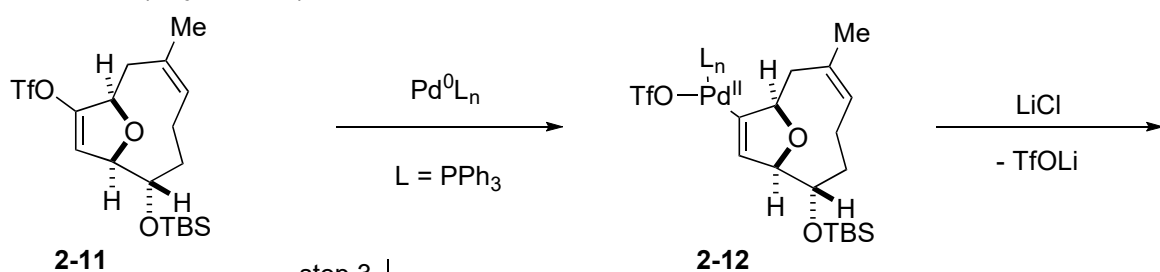
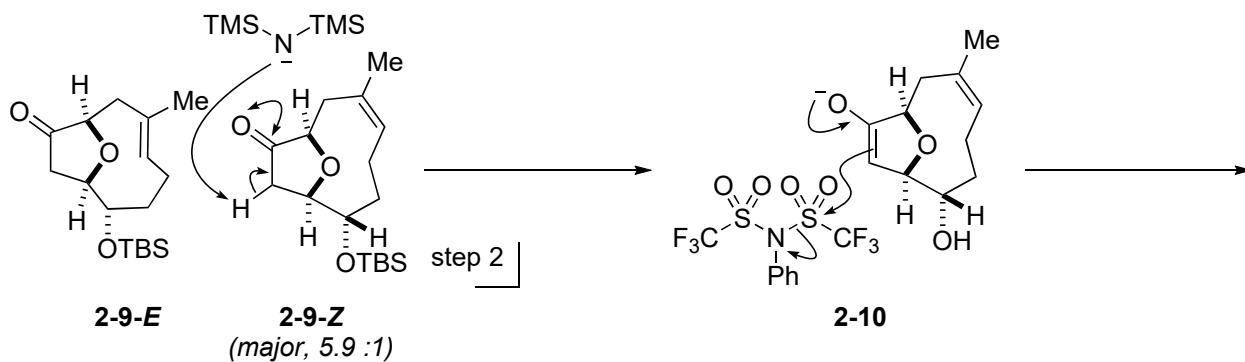
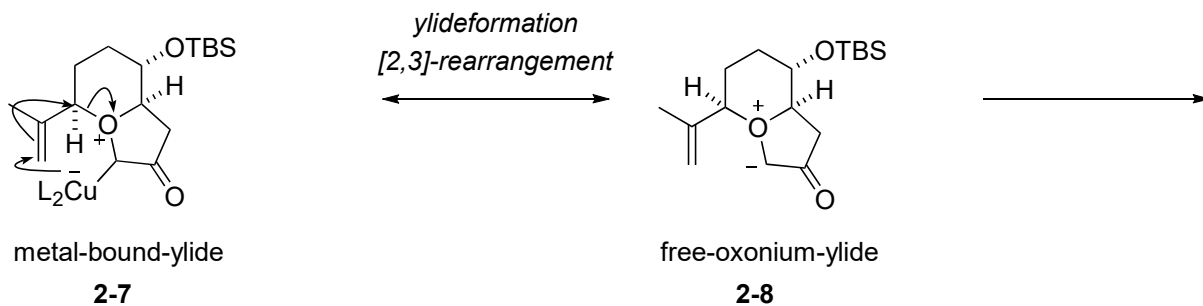
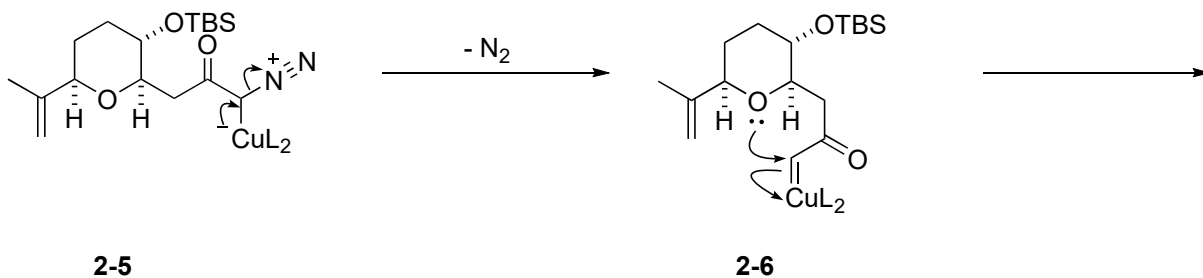
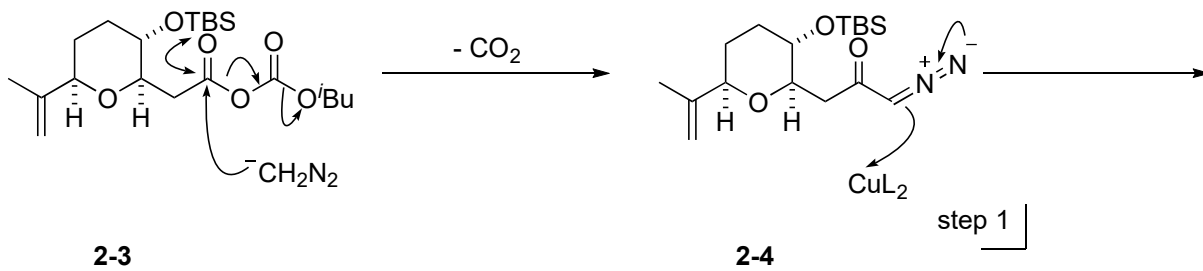
**A**

*J. Org. Chem.* **2013**, *78*, 673

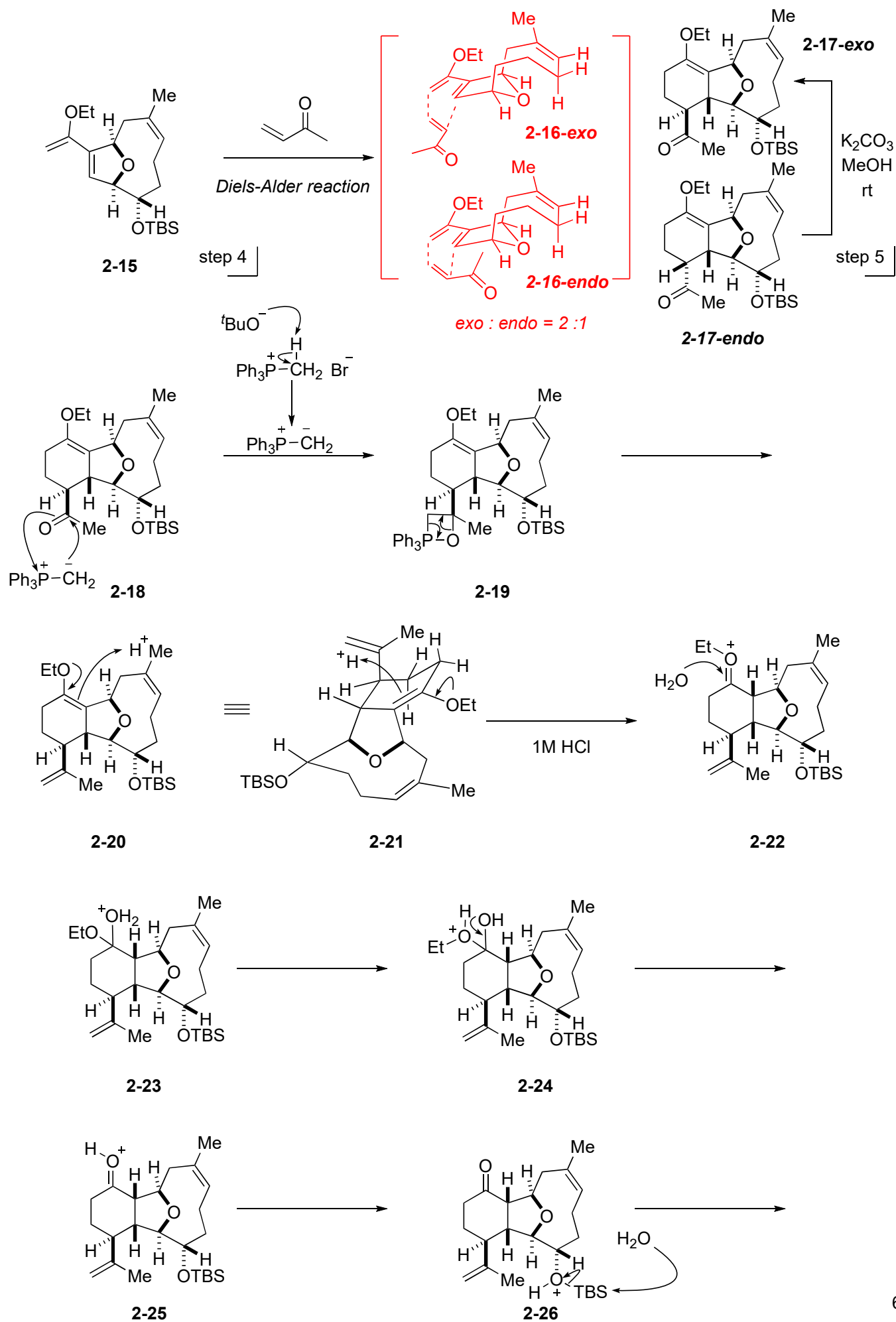


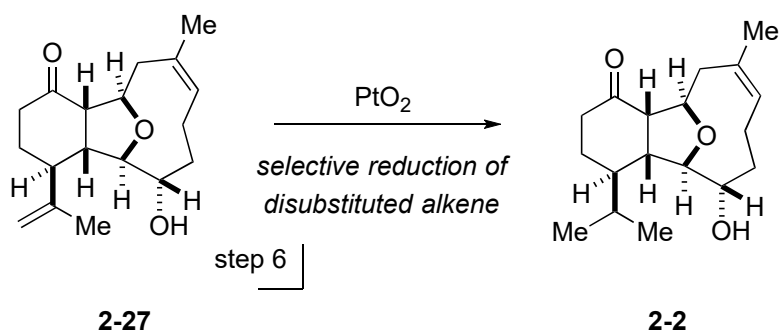
**2-1**

**2-2**



*J. Am. Chem. Soc.* **2000**, *122*, 11771





### References

1. L. E. Overman, *et. al*, *J. Am. Chem. Soc.* **1995**, *117*, 10391
2. M. T. Crimmins, *et. al*, *J. Am. Chem. Soc.* **2006**, *128*, 1371
3. M. T. Crimmins, *et. al*, *J. Am. Chem. Soc.* **2005**, *127*, 17200
4. A. M. Gallego, *et. al*, *J. Am. Chem. Soc.* **2000**, *122*, 11771
5. M. P. Doyle *et. al*, *J. Org. Chem.* **1981**, *46*, 5094
6. D. J. Tantillo, *et. al*, *J. Am. Chem. Soc.* **2020**, *142*, 12937.