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ADDITION OF LITHIUM DIMETHYLCOPPER TO A CYCLOPROPYL ENONE

James A. Marshall and Ronald A. Ruden[1]

Department of Chemistry, Northwestern University

Evanston, Illinois 60201 USA

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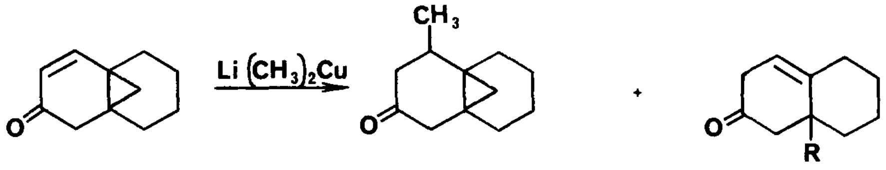
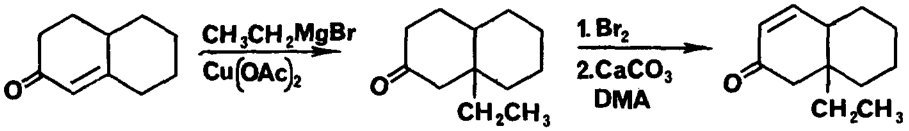
In the course of studies aimed at developing new stereoselective routes to the valencane-eremophilane class of sesquiterpenes[2], we prepared the enone **1** with a view to examining the stereochemistry of methylation with lithium dimethylcopper[3] and the subsequent acidic cleavage[4] of the expected ketonic product(s) **2**. Surprisingly, the addition of enone **1** to ethereal lithium dimethylcopper at 0° afforded not only the desired adduct(s) **2**[5] [λ_{max}^{film} 5.85, 6.92, 8.13 μm; $\delta_{TMS}^{CCl_4}$ 1.12 (CH_3 doublet, J = 6.2 Hz), 0.58 ppm (cyclopropyl CH_2, $\Delta\nu_{AB}$ = 18 Hz, J_{AB} = 6.0 Hz] but the enone **3** as well [λ_{max}^{film} 5.85; $\delta_{TMS}^{CCl_4}$ 5.36 (vinyl H), 0.86 ppm (CH_3, triplet, J = 7.0 Hz)] evidently arising from the heretofore unreported reaction involving conjugate addition to the cyclopropane ring of a cyclopropyl ketone by lithium dimethylcopper. A small amount of the reduction product **4** could also be detected among the reaction products.



1 **2** **3**, R = CH_2CH_3

4, R = CH_3

Additional evidence for the structure of enone 3 was secured through its conversion with methanolic sodium carbonate to the conjugated enone 7 [λ_{max}^{film} 5.97μm; $\delta_{TMS}^{CCl_4}$ 6.18 (vinylic H's, ABX pattern, $\Delta\nu_{AB}$ = 47 Hz, J_{AB} = 10 Hz, apparent J_{AX} = 4.0 Hz, apparent J_{BX} = 1.9 Hz), 2.16 (CH_2CO, AB pattern, $\Delta\nu_{AB}$ = 24.6 Hz, J_{AB} = 15.0 Hz), 0.81 ppm (CH_3, triplet, J = 6.3 Hz). This enone was prepared independently by the following route[6]:



5 6 7

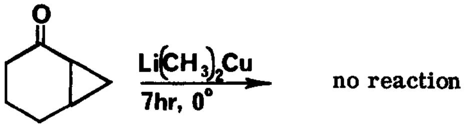
Subsequent studies revealed a moderate solvent and temperature dependence of the 1, 4-addition versus cyclopropane-cleavage reaction pathways (Table 1).

TABLE I

Addition of $Li(CH_3)_2Cu$ to Enone 1

Conditions	2%	3%	4(%)
Ether at -40°	40	55	5
Ether at 0°	55	39	6
Ether at 15°	60	34	6
Dioxane at 15°	72	24	4
Dioxane at 40°	61	33	6

The addition of lithium dimethylcopper to cyclopropyl enone 1 was complete within minutes after mixing of the reagents, even at -40°. Contrastingly, attempts to add this reagent to bicyclo [4.1.0] heptan-2-one (8) led only to recovered ketone after 7hr at 0°. Thus the conjugated double bond seems essential to the cyclopropane cleavage reaction. Cross conjugation does not appear to provide sufficient driving force for cyclopropane cleavage as judged by the reported conversion of cyclopropyl enone 9 to the 1, 4-adduct 10.[7]



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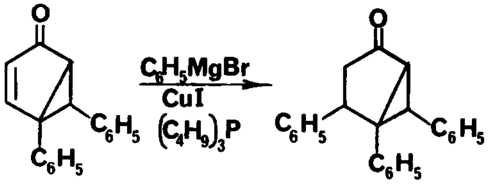
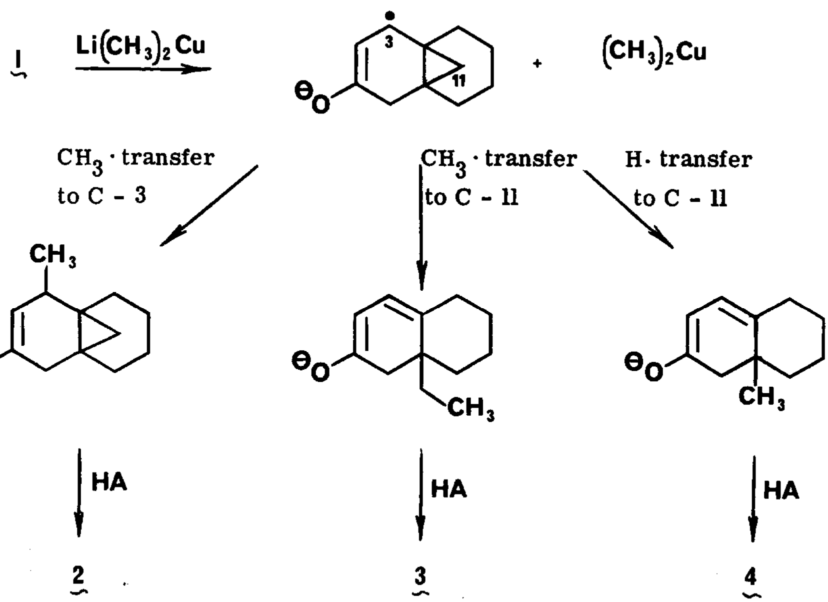


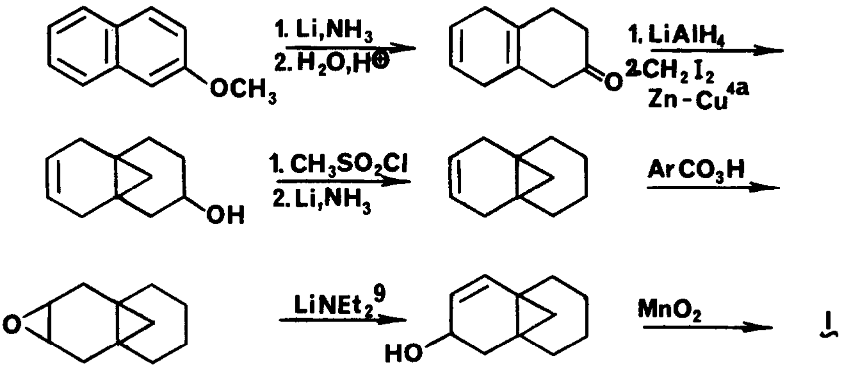
9 10

A possible reaction pathway which accomodates the above findings is presented in Scheme I.[8] Further mechanistic insight awaits the results of additional studies.

SCHEME I
Possible Addition Reaction Pathways



The synthesis of the cyclopropyl enone 1 was effected by following route:



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   b) G. Stork and J. Tsuji, J. Amer. Chem. Soc., **83**, 2783 (1961).
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