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# COMPETITIVE MIGRATION OF SEC-ALKYL GROUPS IN THE BAEYER-VILLIGER OXIDATION

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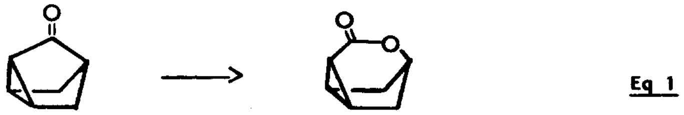
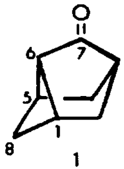
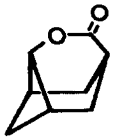
Regioselective synthetic applications of the Baeyer-Villiger oxidation rest on numerous observations that the migratory ability of alkyl groups decreases in the order tertiary, secondary, primary, methyl. This effect has been correlated to the ability of the migrating group to support a positive charge in the transition state. (1) In contrast there is little information available concerning the migratory behavior within a given class of alkyl groups. Among sec-alkyl groups, cyclopropyl is known to migrate least efficiently (e.g., eq 1), presumably due to electronic effects. (2) However, the relative migratory aptitudes of other sec-alkyl groups is not known. Thus the recently observed preferential migration (>98%) of the cyclobutane ring in the trifluoroperacetic acid oxidation of tricyclo[3.2.1.$0^{3,6}$]octan-7-one 1 to give lactone 2 posed an interesting mechanistic question. (3)

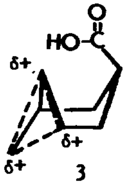

Eq 1



1



2



3

An explanation based on conformational considerations (1) was ruled out since examination of molecular models approximating the transition state for oxidation of 1 did not reveal any obvious conformational factor favoring preferential migration of either sec-alkyl group. In order to evaluate possible electronic effects, the Baeyer-Villiger oxidation of a series of model systems was performed. These data are summarized in Table I. Clearly no significant migratory preferences are observed in these freely rotating model systems, especially in the

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pertinent cases of cyclobutyl *vs.* either cyclohexyl or isopropyl. Thus the rigid skeleton of **1** must play a crucial role.

Examination of models reveals that the conformational disposition of the cyclobutane ring in the rigid, tricyclic skeleton **1** is such that rupture of the $C_6$-$C_7$ bond can be assisted readily by participation of the $C_1$-$C_8$(or $C_5$-$C_8$) cyclobutane bond. Partial stabilization of the incipient positive charge on the migrating carbon atom ($C_6$) by this cyclobutyl-cyclopropyl-carbinyl resonance (see **3**) provides a plausible rationale for the preferential migration of the cyclobutyl moiety in ketone **1**.

TABLE I

Baeyer-Villiger Oxidation of Di-*sec*-Alkyl Ketones, $R-\overset{O}{\overset{\|}{C}}-R'$, with $CF_3CO_3H$[a].

| Ketone | | Product[b] | |
|---|---|---|---|
| R | R' | $R-\overset{O}{\overset{\|}{C}}-OR'$ | $RO-\overset{O}{\overset{\|}{C}}-R'$ |
| cyclopropyl | isopropyl | 24 | 1[c] |
| cyclobutyl | isopropyl | 1 | 1 |
| cyclopentyl | isopropyl | 1 | 1 |
| cyclohexyl | isopropyl | 1 | 1.5 |
| cyclobutyl | cyclohexyl | 1 | 1 |

(a) Method of E.E. Smissman, J.F. Muren, and N.A. Dahle, *J. Org. Chem.*, **29**, 3517 (1964); (b) product ratios determined by vpc analysis of alcohols derived by $LiAlH_4$ reduction of ester mixture; results of two runs; (c) agrees with data given in ref 2b.

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