



## CHAPTER II

### [SUPPL Chapter II # 6]

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Arabic compound numbers in TAPSOC,  
Roman numerals in Supplementary material

### Zero-valent metal reductions employing a different concept from Meerwein-Ponndorf-Verley's.

Reductions based on hydride transfer ultimately require an electron pump from a third party. Zerovalent metals are ideal electron sources albeit very reactive and thus difficult to apply against organic substrates with more than one functional group susceptible to electron capture.

Electron relay offers the advantage of greater regioselectivity in addition to stereo control by using convenient ligands on the non zerovalent metal ion. Although this is not exactly the case of **49** → **51** (Scheme II.9 TAPSOC), the use of a  $\text{Mg}^{+2}$  species suggests that the electron source required for hydride pumping and reduction of **49** is elsewhere. Careful analysis is thus due here.

One way to rationalize this reaction mechanism, according to TAPSOC procedures so far reviewed is this: begin by asking the relevant questions and let the argument grow by itself.

a.- Main visible reaction? The obvious: a reduction of the ketone without affecting the ester, hence a regioselective process, as said above.

b.- Because  $\text{Mg}^{+2}$  is definitely not an electron source, or any other species in the reaction medium for that matter, the reductive species must be a hydride ion.

c.- If assertion (b) is true, we have a problem in our hands: no hydride in sight associated to or associable with Mg. Another source of hydrogen atoms is needed.

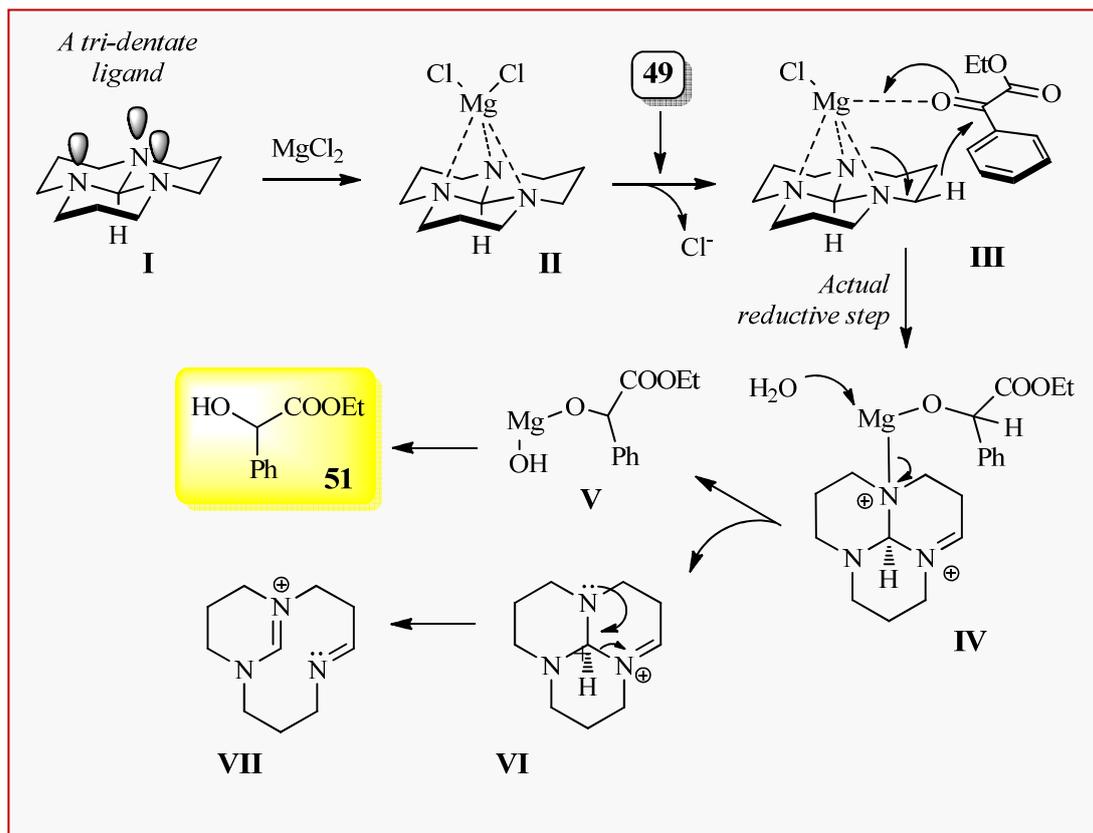
d.- The only H source at hand is the accompanying triamine **50**. But saturated amines in general are not anxious hydride donors unless a tight transition state with the receiver molecule, ideally a LED compound, can be assembled. Negative entropy changes from creating such assemblies are welcome almost always, for regio-, stereo-, and kinetic control.

e.- Also, an electron pump in the amine to help expel H<sup>-</sup> would be handy.

f.- Mg<sup>+2</sup> seems at the root of this. It is a moderate Lewis acid while **50** has all the traits of a powerful Lewis base with its three NBPs pointing in the same direction of space: perfect trap for Mg which may still be able to grab the C=O oxygen as ligand (also a Lewis base) and form one sole complex with all parties held together. This is the kind of assembly we need for intramolecular hydride transfer.

With this preliminary plan, we can begin drawing a mechanism (Scheme S(II)6.1) which speaks for and by itself. The key step is **III** → **IV** whereby the predicted intramolecular C=O··Mg → H-C-O··Mg reductive H shift occurs through a comfortable redeployment of bonding electrons.

After the actual reductive step is accomplished in **IV**, the rest of the sequence is composed by the hydrolytic scission of the Mg species and electronic reconfiguration of the iminium ion **IV**. Pay special attention to **IV** → **V**. From the triamine portion point of view, this is a formal reduction in which electrons are relayed from H<sub>2</sub>O impinging on Mg in this substitution reaction.



SCHEME S(II)6.1