$AlCl_3$ attacks the formyl oxygen atom and causes the C-O bond to break. The CH fragment is then reduced by the hydride in the same molecule, or hydride ligands in other molecules. We cannot rule out the Cp groups as a source of H. However, it is clear that H_2 or D_2, even at 1 atm, can also help reduce the CH fragment at some point in the complex decomposition process.

Trimethylaluminum also reacts with $Ta_2Cp'_2Cl_4(H)(CHO)$. In the presence of four equivalents of $AlMe_3$ the ^1H NMR spectrum of $Ta_2Cp'_2Cl_4(H)(CHO)$ shows a hydride resonance at 8.33 ppm and a formyl proton resonance at 6.5 ppm (J_{HH} = 3 Hz). Two formyl carbon resonances are observed at 227 and 214 ppm, the first a broad doublet (J = 156 Hz), the second a double doublet (J = 153 and 9 Hz). This product can be isolated as a pentane soluble yellow oil which decomposes slowly 25° to give methane (not quantified). If less than 3-4 equivalents of $AlMe_3$ are added a more complex mixture of products is generated. Almost certainly the metals are being alkylated step-wise by $AlMe_3$. Since the methyl groups initially in $AlMe_3$ are likely sources of at least some of the methane, we did not study the formation and decomposition of the $AlMe_3$ product in detail.

$Ta_2Cp'_2Cl_4(H)(CHO)$ also reacts with BH_3•THF to yield a substantial quantity of methane (not quantified). Borane (or BH_4^-) has been used in several instances to reduce a carbon monoxide ligand, ultimately to methane.[14] Initial attack at the formyl oxygen atom is again a likely first step.

The Reaction of $Ta_2Cp'_2Cl_4(H)(CHO)$ with HCl

Methanol (>80%) is produced when excess aqueous HCl is added to $Ta_2Cp'_2Cl_4(H)(CHO)$ in propanol (equation 3). If HCl gas is used in aprotic