5. Summary

A number of gold fluor compounds have been synthesized and its structures determined. Some structural principles of the octafluorometalates of Re and U have been elucidated.

1. Octafluororhenate(VII) and Octafluorouranate(VI)

Re and U form high oxidation states. Even then their ionic radii are fairly large. That is why Re and U are capable of forming stable eight coordinated fluorocomplexes.

The following compounds were prepared and their crystal structures determined.

$CsReF_8$ **$(NO)_2UF_8$**

The following Octafluororhenates(VII) and Octafluorouranates(VI) were prepared and characterized by Raman spectroscopy:

$(NO)ReF_8$ **$(NO_2)ReF_8$** **$(CH_3)_4NReF_8$**

Cs_2UF_8 **$(NO_2)_2UF_8$** **K_2UF_8**

The spectra appear similar for all compounds.

All attempts to prepare simple crystals of octafluorouranate(V) failed.

Thus far the following structural principles seem valid for eight coordinated fluorocomplexes:

1. The geometry of the anion is a fairly regular square antiprism, regardless of the cation involved.

2. The averaged angle α as a measure for the distortion of the square antiprism depends somewhat on the electronic configuration of the central atom:

   $4d^{10}$: 57.6° $4d^{10}\,5s^2$: 57.9° $5d^1$: 57.9°

   $5d^0$: 57.5° $5f^0$: 57.0°

   Compare $\alpha = 57.1°$ for an ideal square antiprism.

3. The M-F bonding distances are affected by cation-anion interactions. For UF_8^{2-} distances reaming from 207 pm to 215 pm are observed.

The compounds **$Cs(Re_2N_2F_9)$** and **$Ca(H_4)(U_4O_8F_{14})$** were obtained by accident. Their crystal structures have been solved.

The crystal structures of **ReF_6** has been redetermined from single crystal data.

2. Gold fluorides

The following gold fluor compounds were prepared and their crystal structures determined.

O_2AuF_6 **$(AuF_5)_2$**

$(Au_3F_7)(SbF_5)_3$ **$(Au_3F_8)(SbF_5)_2$** **$[Au(HF)_2][(SbF_6)_2]\cdot 2(HF)$**

A new modification was obtained for **Dioxygenylhexafluoroaurat(V)** comprising an ordering variant of the known (disordered) structure.

Gold pentafluoride is the only pentafluoride with a dimeric structure in the solid state. It is an extreme stronger Lewis-acid, even stronger than SbF_5. This is suggested by Ab-initio calculations.

$(Au_3F_7)(SbF_5)_3$ is a mixed valence gold(II/III) fluor compound. The structure comprises ribbons extending into infinity in one dimension.

$(Au_3F_8)(SbF_5)_2$ comprises a layer structure. It may be written more appropriately as $[Au^{II}(Au^{III}F_4)_2](SbF_5)_2$. Comparison of the fluor-bridging distances in the (Au-F-Sb)-unit suggests that AuF_3 is a stronger F^- acceptor than the SbF_5 molecule in the solid state.

$[Au(HF)_2][(SbF_6)_2]\cdot 2(HF)$ is the first know Au-HF-coordination compound.