The DMQ project has reviewed global IOCG deposits (and districts) and distilled empirical characteristics and process-oriented, essential ingredients. The new comprehensive agreed, unifying characteristics of the IOCG family of mineral systems are:

- abundant, low-Ti, Fe-oxides: magnetite and/or hematite
- Fe-Cu-Na at economic grades
- a distinction suite of minor elements (monochalcophile Ag,REE, U, Mo, P, Ni, As, Co, & Ba)
- an association with magmatic & phyllic alteration – both sodic-calcic, Na-(Ca) and potassic, K
- formed in shallow crustal environments, in brittle regimes (in the 2-12km depth range)
- prominent structural / stratigraphic control
- most commonly coeval, but (possibly) not proximal to, significant magmatism
- common district association with Cu-Au 'barren', Fe-oxide deposits
- non-magmatic brine involvement: hydrothermally and/or metasomatized
- mafic metal-source rocks

Schematic member IOCG system models (highlighting the wide spectrum of potential fluid system permutations (from Barton & Johnson (2004), modified by Williams et al. (2005, 2010)). These models emphasize essential, and perhaps some less-essential, IOCG system ingredients:

- (a) shallow brine – of basinal / formational evaporitic origin (± magmatic contribution)
- (b) heat-driven fluid circulation systems – in the 2-12km depth range
- regional high-temperature, brine circulation, sodic-calcic alteration – Fe-K metal-sourcing, albito-scapolite
- structurally-focused, iron-potassic alteration – magnetite-dominated, biotite-magnetite
- erratic magmatic contributions – metals, S, Ag, Cu, Mo, F, Ni, As, Co, & Ba
- surficial oxidized fluid input – cooling, metal contribution, hematite-dominated, acid-potassic alteration

In nature, blends of all end-members and components are possible within single systems. Furthermore, IOCG deposits may be formed in related systems with either coeval or superimposed contributions of different deep-seated (hyper)saline brines. The additional complexity of such hydrosulfuric systems has led to a more detailed understanding of the wide spectrum of potential fluid system permutations.

**Results For One Geographical Area**

1. **IOCG Process Models – Regional Alteration**
   - Innovative IOCG process models and associated visualization tools were developed in collaboration with Professor Alice Clark (DADE UQ). These models utilize dynamic visualization software and provide insights into the complex spatial and temporal relationships of IOCG deposits.
   - **Regional High Temperature Brine Circulation Model**
     - **Olympic Dam**: High-grade, magnetite-rich deposit formed in a complex, multi-stage evolution involving significant magmatism and brine circulation.
     - **Mantoverde Norte**: Moderate to high-grade deposit formed in a structurally-controlled setting with significant magmatic and brine contributions.
     - **Mt Elliott**: High-grade deposit formed in a shallow, oxidised environment with significant magmatic and brine inputs.

2. **IOCG Process Models – Essential Ingredients**
   - Essential ingredients of IOCG systems are abundant, low-Ti, Fe-oxides: magnetite and/or hematite, formed in shallow crustal environments, in brittle regimes (in the 2-12km depth range).
   - Prominent structural / stratigraphic control is most commonly coeval, but (possibly) not proximal to, significant magmatism.
   - Common district association with Cu-Au ‘barren’, Fe-oxide deposits.

3. **Interpretation of Olympic Dam**
   - Olympic Dam is a large copper-gold deposit located in South Australia. The deposit is characterized by a complex array of ore bodies, each with unique mineralogical and textural characteristics.
   - **Manto Replacement Ore**: Hematitic, high-grade ore bodies formed in a shallow, oxidised environment with significant magmatic and brine inputs. These ore bodies are associated with metasomatic alteration that has resulted in significant potassium and iron enrichment.
   - **Pipe-Like Ore**: Shallow, oxide-rich deposits, characterized by high copper and gold grades, formed in a shallow, oxidised environment with significant magmatic and brine inputs.

**Shallow Transitions**
- Shallow transitions (both spatial and genetic) from barren to Cu-Au (both) metasomatism to ore-stage assemblages in four Andean IOCG deposits. Note significant temperature decreases and heavy shifts in calculated δS values (δS values in red), associated with shift from Cu-sulphide-precipitation, 6-Fe(Cu) magnetite-dominated, sulphide-sulphide assemblages to hematite-dominated, Cu sulphide-rich assemblages. This shift is associated to mining of a deep-sourced, high temperature, hypothermal brine with a postulated, low temperature, surficial, oxidized brine of external basinal source. (from Chen et al., [2020])