FACILITIES, INDIVIDUALS, AND INDIVIDUALS IN FACILITIES

What's in a name? That which we call a Facility may not always smell as sweet

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CONCLUSIONS

- Developments depend on individuals, using state-of-the-art analytical and instrumental capabilities, “around the clock”
- There must be a mix of individual PI state-of-the-art capabilities and of state-of-the-art facilities
- Advances are by talented individuals with multi-disciplinary approaches
- Funding is critical for new developments: Stable funding is necessary
- Discipline Scientists should support seminal and difficult developments, as opposed to review panels which count publications
- FACILITY FUNDING IS NOT A COST-SAVING CONCEPT AND NOT A SUBSTITUTE FOR STAND-ALONE PI SUPPORT
- FACILITY DEVELOPMENT TAKES ADVANTAGE OF STATE-OF THE-ART DEVELOPMENTS IN PI LABORATORIES
- INDIVIDUAL PIs NEED TO BE SUPPORTED BEFORE SUPPORT FOR FACILITIES STARTS TO MAKE SENSE

Facility: Capabilities

- A Facility consists of a group of talented persons who can develop or have developed a unique set of analytical capabilities and have the drive to pursue further analytical developments
- These capabilities are of wide interest and application
- Contains state-of-the-art instruments
- Includes staff to maintain state-of-the-art analytical capabilities
- Includes staff to operate the Facility for guest investigators and to address the needs of these investigators
- Serves a stable community of imaginative investigators

Facility: Funding

- Funding for maintaining the instruments (e. g., service contracts) as well as resident electronics engineers for home-built electronics and for avoiding frequent service calls, which result in expensive time delays
- Funding for the various types of staff identified above: development, support, operation
- **Stable, multiple year funding is needed** so that the facility innovators, operators, and support services do not have to depend on hand-to-mouth support from user fees
- Patience in funding: Rome was not built in a day

Facility: Investigations

- Schedule for guest investigators
- Use of existing capabilities: guest investigators submit their samples, obtain results, publish the results, on their own, simply acknowledging the Facility used
- Collaborative development with a guest investigator of new analytical capabilities: publication of results reflects guest investigator and Facility persons contributing to the specific development effort
- While part of the available time may be used by talented facility persons and other interested persons for development of new capabilities, it is expected that the Facility be reliable and available to users for a large portion of time.

Facility: Investigations (cont.)

- Corollary: the analytical capabilities are well developed and, therefore, may be considered routine
- “Routine” is not a pejorative term. It simply means consistent and reliable capabilities, not under constant development
- Guest investigators know what to expect, when their samples are being analyzed, without the risks from continuous upgrades
- To the extent that the Facility instruments operate at the-state-of-the-art, they need to be operated by experienced personnel and not by the guest investigators, who may not be adequately trained
- Use of the “routine” capabilities of a Facility is based on the payment of established user fees and members of the Facility do not expect to become co-authors of the papers that use the data obtained by or for guest investigators of the Facility

CONTRAST: Facilities and Stand-alone PIs

Most seminal advances are made by individual investigators

List from own experience

- Development of the chemical separation for REE, applied to Gd and then to Sm, for the measurement of secondary thermal neutron capture effects in the lunar regolith
  - Led to the development of Sm-Nd dating in cosmochemistry and then in geochemistry
  - Provided the impetus for Don Burnett's neutron probe, flown on Apollo 17
- Development of thermal ionization of Gd, Sm, and Nd as the oxides (GdO^+, SmO^+, NdO^+), with much higher ionization efficiency than for Gd^+, Sm^+ Nd^+.
- Development of U-Th-Pb capabilities, not available during the Apollo missions.
  - One of the fundamental results: the recognition of the Late Lunar Cataclysm, 4.0 Ga ago
  - Concept is the cornerstone for lunar chronology, leading to a new understanding of the evolution of Solar System and planetary dynamics and to New Frontiers mission proposals
- Serendipity development: ionization of Mg by the use of SiO_2-gel and H_3PO_4 (as used for Pb), which eventually led to the discovery of ^{26}Al and the ^{26}Al-^{26}Mg chronometer
- Development of the ^{107}Pd-^{107}Ag chronometer
- Endemic isotope anomalies in Ti, with the development of Ti chemistry, using the strong complex, $TiF_6^=$, coupled with the discovery that TiO^+ ionizes much more efficiently than Ti^+
- Development of negative-ion mass spectrometry for Platinum Group Elements

CONTRAST: Facilities and Stand-alone PIs (cont.)

- These, individual investigator advances were multi-year developments, including trial and error
- These developments could not have been made in a facility, on a limited, time-available basis
- PI-led analytical facilities and instruments
- The developments listed above could not have been made on less capable, non-state-of-the-art instruments
- For example, ionization of Gd, Sm, Nd as oxides depended on the conditions in the Lunatic I ion source
  - The details were not fully recognized until nearly a decade later
  - Attempts by others to reproduce the ionization efficiency on other instruments failed, for reasons not understood at the time.