Second Exam
Resources From Space
NEEP 602/Geology 376
Friday, November 7, 1997

Each question worth 20 points

1) List seven (7) of the principal mining and benefaction constraints including "natural (geological) controls of resource distribution" that should be considered in designing lunar mining equipment and in planning a lunar mining support base. For each constraint you list, briefly discuss why each would affect the cost of producing solar wind volatiles from the lunar regolith.

2) a.) If any, what major resource(s) can we expect to produce on Mars for use on Mars,
b.) what major resource(s) can we expect to produce on Mars for return trips to Earth,
c.) what major resource(s) can we expect to produce on Mars for export to Earth?

3) On Earth, the elements Al, Ti, and Fe are mined from the highest grade deposits available, essentially irrespective of where they are located geographically on the globe. All three of these metals are usually recovered from sedimentary or surficial deposits. In addition, seldom are these three commodities recovered together and their markets are independent of one another.

How would you rewrite the above 3 sentences if the paragraph began: "On the Moon, ..." and you were writing this after permanent settlements had been established sometime in the next 50 years? Provide some justification for your answer.

4) a.) If the average energy of a solar wind ^{3}He atom incident on the lunar surface is ≈3 keV and at that energy it can only penetrate 250 Å into the regolith, why do we find ^{3}He down to at least 2 meters?

b.) Why is it beneficial, from an energy investment standpoint, to thermally process only the smaller grains of lunar regolith for solar wind volatiles?

c.) If no one has yet found water on the lunar surface, why did we say that for every tonne of ^{3}He extracted from lunar ilmenite at 700°C, we would get 3,300 tonnes of water?

5.) List 4 advantages and 2 disadvantages of generating electricity from the fusion of D & ^{3}He (vs the DT cycle)?