INTRINSIC OXYGEN FUGACITY MEASUREMENTS FOR CLASTS IN DIOGENITES AND MESOSIDERITES, Roger H. Hewins[1] and G.C. Ulmer[2], [1]Dept. of Geological Sciences, Rutgers University, New Brunswick, N.J. 08903, [2]Dept. of Geology, Temple University, Philadelphia, Pa. 19122

Could mesosiderites come from the same parent body as the common achondrites? One way to answer this question is to find whether mesosiderite clasts which have not equilibrated with breccia matrix are identical to monomict igneous meteorites or merely similar. We have made a comparison of clasts in mesosiderites with material from diogenites by measuring intrinsic oxygen fugacities, to see whether the source rocks for these breccias cooled under different redox conditions.

Experimental The technique of direct oxygen fugacity measurement using double ZrO_2 cells is well known (1,2). We followed the technique of (2) closely and tested the cell by running wüstite-magnetite as an unknown. The samples, taken from the centers of very large (cm) crystal clasts so as not to be equilibrated with matrix, were Johnstown (En_{74}), Tatahouine (En_{76}), Estherville (En_{81}), Emery (En_{68}) and West Point (Fo_{88}). All samples appeared to be monomineralic, except for tiny opaque inclusions (metal, troilite and chromite). These were abundant only in the Emery and West Point samples, which also contained red-coated fractures ("rust"), and could possibly make contributions to the measured oxygen fugacity. Because of limited sample availability, little could be done to minimize or evaluate this possibility.

Selected results are shown in the figures. The data show how the samples cooled from temperature of last equilibration, solidus or sub-solidus, which is not indicated by this method. All runs were very coherent in temperature cycles between 800 and 1150°C. In particular there was no autoreduction as is associated with the presence of graphite.

Discussion The results record lower oxygen fugactities than the magnetite-bearing meteorite Nakhla (3) and higher values than chondrites which are metal-rich (4,5). Diogenites show higher oxygen fugacity than mesosiderite orthopyroxene but note that pyroxene from the Tatahouine diogenite and the Estherville mesosiderite are the same within experimental error. This indicates that some diogenite and mesosiderite orthopyroxenes cooled under essentially the same redox conditions, and although reduction may have occurred in the mesosiderite matrix (6,7) some clasts did not reequilibrate. The Emery pyroxene is the most reduced material studied and the measured oxygen fugacity matches the value previously calculated for 1000°C (7). Either this sample crystallized from a more reduced magma or it subsequently equilibrated with the metal-rich matrix.

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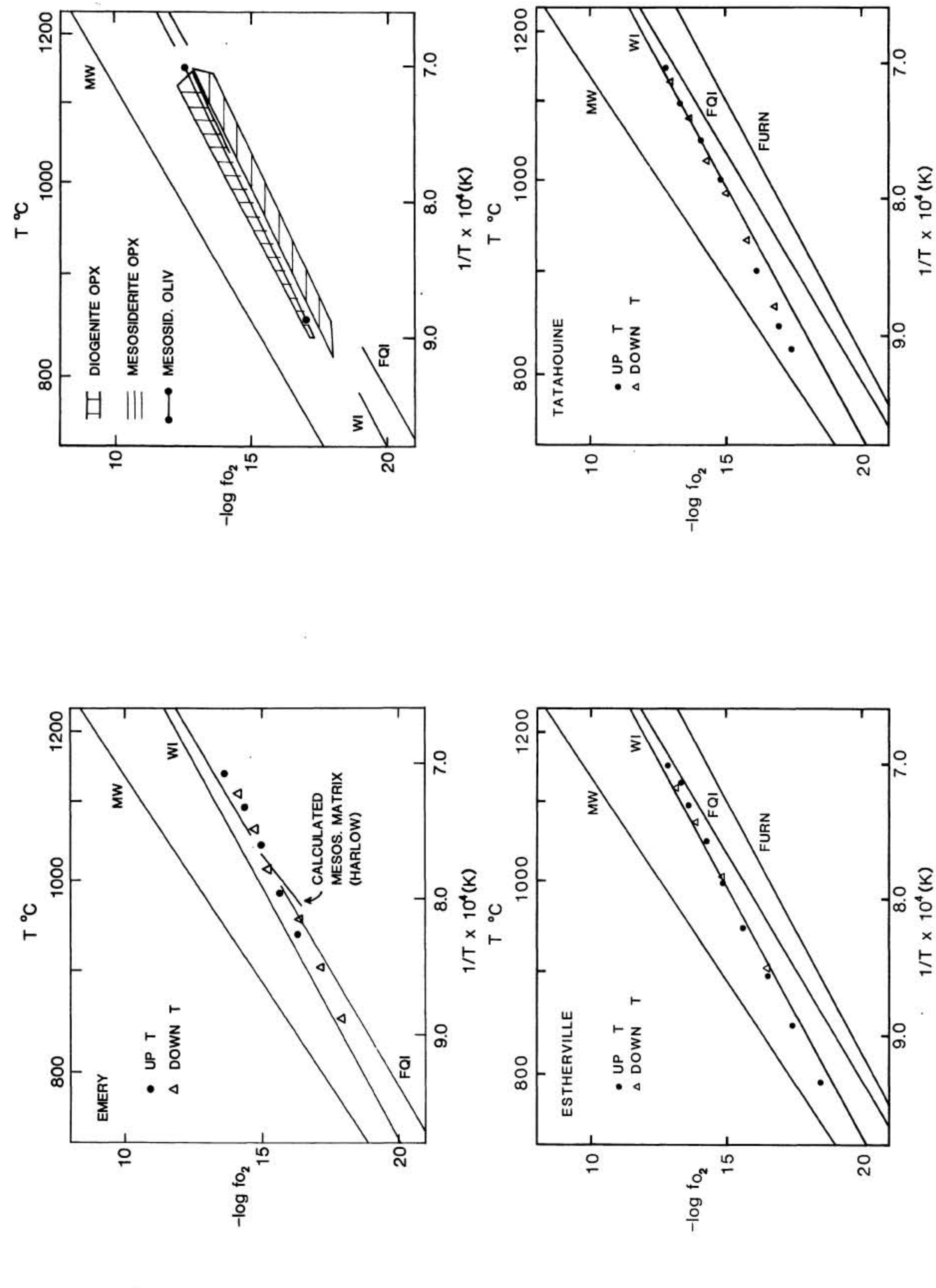
T °C
-log f_{O_2}
1/T x 10^4(K)
DIOGENITE OPX
MESOSIDERITE OPX
MESOSID. OLIV
MW
WI
FQI
TATAHOUINE
UP T
DOWN T
FURN
EMERY
CALCULATED MESOS. MATRIX (HARLOW)
ESTHERVILLE