THE PALLADIUM ISOTOPIC COMPOSITION IN IRON METEORITES. J. H. Chen[1] and D. A. Papanastassiou[2], Div. Earth and Space Sciences, Jet Propulsion Laboratory, Caltech, Mail Stops 183-601[1] and 183-335[2], 4800 Oak Grove Dr., Pasadena, CA 91109-8099 (James.H.Chen@jpl.nasa.gov).

Ru, Mo and Pd are very useful indicators for the identification of nucleosynthetic components. We have developed techniques for Pd isotopes, in an effort to check the extent of isotopic effects in this mass region and for a Pt-group element which is less refractory than Ru. Stable Pd isotopes are produced by the p-process only (^{102}Pd), the s-process only (^{104}Pd), the r-process only (^{110}Pd) and by both the r- and s-processes (^{105}Pd, ^{106}Pd, ^{108}Pd). Kelly and Wasserburg [1] reported a hint of a shift in ^{102}Pd (~25εu; 1εu≡0.01%) in Santa Clara. Earlier searches for Mo and Ru isotopic anomalies were either positive or negative [2-8]. Some workers argued that no convincing isotopic differences could be resolved at the bulk rock scale, and any residual effects, after correcting for instrumental factors probably represented *artifacts* that were poorly understood. We have measured the isotopic compositions of Ru and of Mo in iron meteorites, pallasites, Allende and Murchison whole rock samples and in Allende CAIs. We have established the presence of endemic effects for Ru in irons and in carbonaceous meteorites and confirmed the presence of endemic Mo anomalies, as reported by Dauphas et al. [7-8] for irons and of Ru anomalies in the Allende and Murchison whole rock samples as reported by Yin and Jacobsen [6]. We have also identified a pattern for Mo, in the Pink Angel, a CAI from Allende, which follows the s-process effects reported by Savina et al. [9], for preserved interstellar SiC.

The isotope effects in macroscopic samples are very small and require high precision measurements and clean chemical separations, in order to eliminate mass interferences. In this work for Pd, we have reduced Ru and Cd isobaric interferences by using multiple anion and cation exchange clean-up chemistry. We verified the chemical yields (>80%) and chemical purity (>99.99%) of the separated Pd, by using a new graphite furnace atomic absorption spectrometer. Pd was loaded on a high purity Re filament, with silica gel and phosphoric acid. The isotopic composition was determined, for positive Pd^+ ions, on the Triton mass spectrometer, with simultaneous ion collection. The data on normal Pd are shown in Fig. 1a (22 analyses, during the period of these experiments). The uncertainties are: ^{102}Pd 1.8 εu; ^{105}Pd 0.3εu; ^{106}Pd 0.3εu; ^{110}Pd 0.4εu (all 2σ). The uncertainties in ^{102}Pd reflect its abundance of only 1%. Results on a pallasite (Salta) and on six iron meteorites (Toluca, Gibeon, Deep Spring, Seneca Township, Santa Clara, and Pinon) are shown in Fig. 1b-h. In these graphs, the gray lines represent the reproducibility (±2σ) for normal Pd. For meteorites, the black circles represent data normalized to ^{110}Pd/^{104}Pd (1.0604, [1]), while the red squares are the same data normalized to ^{108}Pd/^{104}Pd. This is our preferred normalization, because any mass interference from Cd is much smaller at ^{108}Pd than at ^{110}Pd. The green and yellow triangles represent data corrected for Cd interference and normalized to ^{110}Pd/^{104}Pd and ^{108}Pd/^{104}Pd, respectively. Finally, the blue diamonds represent data corrected for both Cd and Ru (at ^{102}Pd) interferences, and normalized to ^{108}Pd/ ^{104}Pd. The error bars (shown only for the blue diamonds) are $2\sigma_m$. Only two samples, Salta and Deep Spring required a small (1-1.5εu) correction for ^{110}Cd. Only Toluca, Santa Clara and Deep Spring required a small correction for ^{102}Ru. The effects on ^{102}Pd (1% abundance) are sensitive to ^{102}Ru interference (32% abundance). The final data (blue points) show no resolvable isotope effects for Pd, with the possible hint of excess ^{102}Pd for Pinon. With these high precision data, we do not confirm the possible effect in ^{102}Pd, for Santa Clara [1]. For the meteorites analyzed here for Pd, the absence of resolvable Pd isotopic anomalies is consistent with the absence of Mo anomalies on the same meteorites, as reported by us [10]. However, for the samples we analyzed both for Ru and Pd we have found resolvable deficits in ^{100}Ru/^{101}Ru in Gibeon (-0.4±0.08εu), Salta (-0.4±0.08εu) and Pinon (-0.83±0.1) [11]. These effects are associated with a deficit in the s-process component in the s-only ^{100}Ru. Using the abundances for s-process nucleosynthesis [12] we estimate that a small deficit (2.2×10^{-4}) in ^{100}Ru relative to the solar abundance can produce a -1.7εu shift in ^{100}Ru/^{101}Ru. If Pd showed a deficit in the s-only ^{104}Pd of 2εu (to match the Ru data on Pinon), this deficit would be manifested (after fractionation correction) as resolved excesses of 0.77εu and 0.85εu in ^{105}Pd and ^{106}Pd, respectively, as a deficit of 0.25εu in ^{110}Pd (not resolvable), and as an excess in ^{102}Pd of 2.75εu, which would be resolvable with our current precision for ^{102}Pd. Since no resolved effects in ^{102,105,106}Pd are present, the Pd data are not consistent with the endemic s-process effects observed for Ru, in the same meteorites. We conclude that the effects in Ru may be preserved due to the incorporation of Ru in high temperature metal condensates, in which Pd was not included. Or the Pd

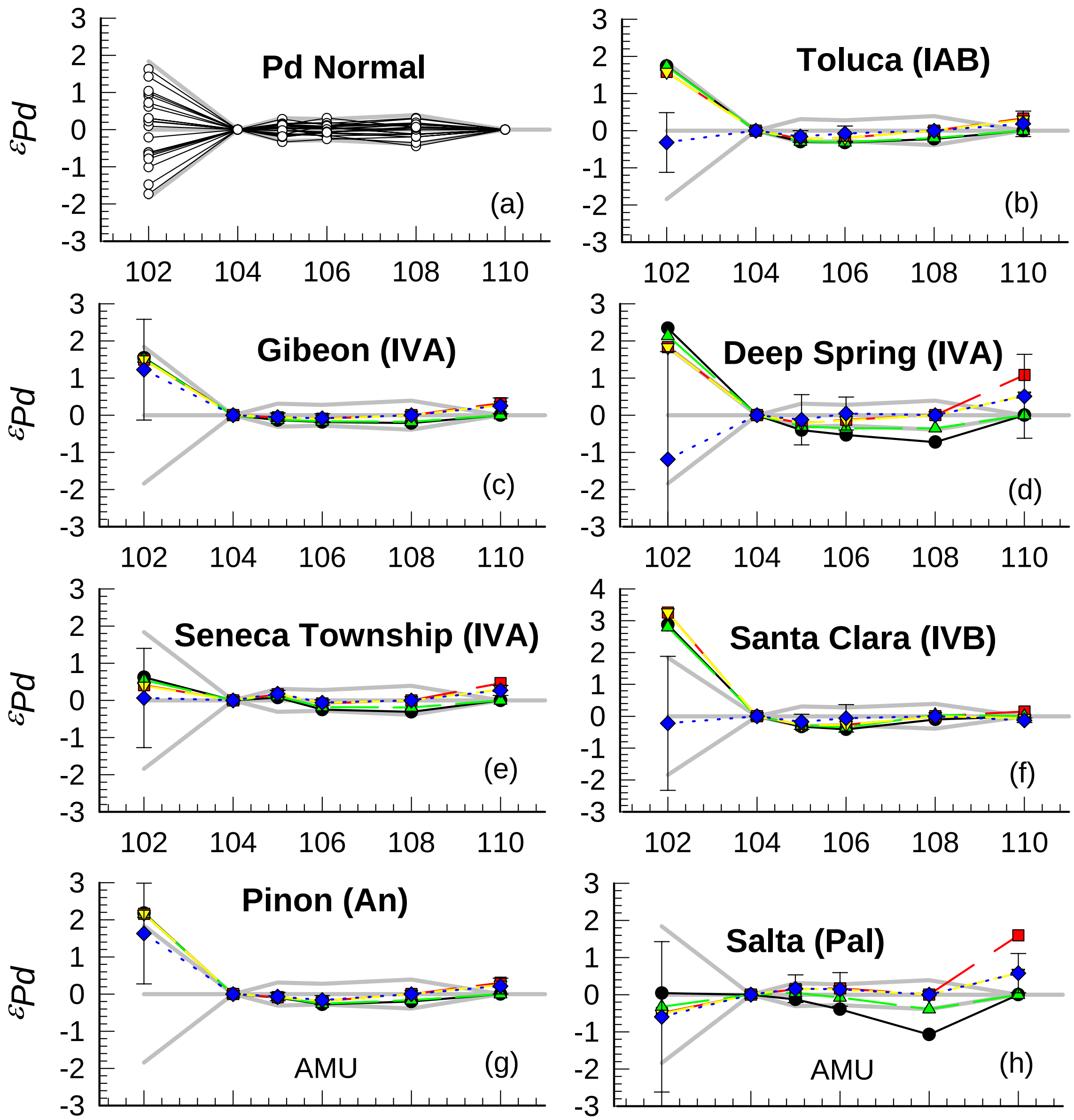

Fig. 1. Pd isotopic composition in terrestrial normal, pallasite and iron meteorites.

in iron meteorites is dominated by normal Pd, condensed in FeNi, at lower temperatures. Measurements on other iron meteorites, carbonaceous meteorites and in CAIs are in progress.

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