

Asteroid Value

diameter (m): **500**
 radius (cm): 25,000
 volume (cm³): 65,449,791,666,667 (4/3πr³)

**Platinum group metal (PGM) value
 of a near-Earth asteroid
 (H ordinary chondrite)
 with diameter ~500 m
 and the density of
 Itokawa or Eros**

Itokawa density

(1.95 g/cm³):
 (rubble pile) g: 127,627,093,750,000
 kg: 127,627,093,750
 metric ton: 127,627,094

Platinum group metal	H O. Chondrite (ppm)	g/asteroid	oz t/ast.	\$/oz t*	\$/asteroid
44 Ru Ruthenium	1.100	140,389,803	4,513,637	580	2,616,103,994
45 Rh Rhodium	0.210	26,801,690	861,694	6,191	5,334,361,852
46 Pd Palladium	0.845	107,844,894	3,467,294	355	1,230,369,227
77 Ir Iridium	0.770	98,272,862	3,159,546	447	1,412,159,034
78 Pt Platinum	1.580	201,650,808	6,483,224	1,304	8,452,179,165
		574,960,057	g		\$19,045,173,272
		574,960	kg		
		575	ton: return		

Eros density

(2.67 g/cm³):
 (solid) g: 174,750,943,750,000
 kg: 174,750,943,750
 ton: 174,750,944

Platinum group metal	H O. Chondrite (ppm)	g/asteroid	oz t/ast.	\$/oz t*	\$/asteroid
44 Ru Ruthenium	1.100	192,226,038	6,180,211	580	3,582,050,084
45 Rh Rhodium	0.210	36,697,698	1,179,858	6,191	7,303,972,381
46 Pd Palladium	0.845	147,664,547	4,747,525	355	1,684,659,403
77 Ir Iridium	0.770	134,558,227	4,326,147	447	1,933,571,601
78 Pt Platinum	1.580	276,106,491	8,877,030	1,304	11,572,983,779
					\$26,077,237,249

Detected NEAs: 5,767 *
 Detected NEAs D ≥ 500 m: 2,161
 Expected NEAs D ≥ 500 m: ~6,000

Detected VNEAs D ≥ 500 m: 82 **

Observed-fall meteorites that are
 H ordinary chondrites: 28%

* Metal prices: 2007 average; detected asteroids: November 2008

** VNEAs (very-near-Earth asteroids) are easier to reach than the moon.

Annual PGM demand (2007): 495 ton
 International Space Station (final): 470 ton

Data sources

Asteroid densities

Itokawa: Abe S, Mukai T, Hirata N, et al. Mass and Local Topography Measurements of Itokawa by Hayabusa. *Science* 2006;312(5778):1344-47.

Eros: Miller JK, Konopliv AS, Antreasian PG, et al. Determination of Shape, Gravity, and Rotational State of Asteroid 433 Eros. *Icarus* 2002;155:3-17.

Asteroid size estimates (H 19.5 → D: 330 - 750 m; average D: 540 m)

NASA. Near Earth Object Program. Glossary: Absolute Magnitude (H)
<<http://neo.jpl.nasa.gov/glossary/h.html>>

NEA and VNEA populations

Benner L. Delta-v for spacecraft rendezvous with all known near-Earth asteroids ($q < 1.3$ AU). NASA JPL.
<http://echo.jpl.nasa.gov/~lance/delta_v/delta_v.rendezvous.html>

Bottke WF Jr, Durda DD, Nesvorný D, et al. Linking the collisional history of the main asteroid belt to its dynamical excitation and depletion. *Icarus* 2005;179:63-94.

Ordinary chondrite elemental abundances

Lodders K, Fegley B Jr. *The planetary scientist's companion*. Oxford: Oxford University Press; 1998.

Observed-fall meteorite statistics (H ordinary chondrites)

The Meteoritical Society. Meteoritical bulletin database.
<<http://tin.er.usgs.gov/meteor/metbull.php>>

PGM prices and annual demand

Johnson Matthey. *Platinum 2008: March 2008*.
<http://www.platinum.matthey.com/uploaded_files/Pt2008/08_complete_publication.pdf>

International Space Station

<http://en.wikipedia.org/wiki/International_Space_Station>