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Геологический факультет

Re-Os и Pt-Os системы

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Задачи (*.xlsx) и лекции (*.pptx) – на сайте
[http://wiki.web.ru/wiki/Геологический Факультет МГУ:
Геохимия_Изотопов_и_Геохронология](http://wiki.web.ru/wiki/Геологический_Факультет_МГУ:Геохимия_Изотопов_и_Геохронология)



$$\lambda_{187} = 1.666 \times 10^{-11} \text{ год}^{-1}$$

(Smoliar et al., 1996)



$$\lambda_{190} = 1.477 \times 10^{-12} \text{ год}^{-1}$$

(Begemann et al., 2001)

$$\left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}} \right)_{\text{CHUR}} = 0.1270$$

$$\left(\frac{{}^{187}\text{Re}}{{}^{188}\text{Os}} \right)_{\text{CHUR}} = 0.40186$$

(Shirey, Walker, 1998)

$$\left(\frac{\text{Re}}{\text{Os}} \right)_W = \left(\frac{{}^{187}\text{Re}}{{}^{188}\text{Os}} \right)_{\text{AT}} \cdot ?$$

	at %%	AW
${}^{184}\text{Os}$	0.018%	
${}^{186}\text{Os}$	1.584%	
${}^{187}\text{Os}$	2.400%	
${}^{188}\text{Os}$	13.176%	190.21
${}^{189}\text{Os}$	16.058%	
${}^{190}\text{Os}$	26.146%	
${}^{192}\text{Os}$	40.617%	
${}^{192}\text{Os}/{}^{188}\text{Os} \equiv 3.0827$		
${}^{185}\text{Re}$	37.07%	
${}^{187}\text{Re}$	62.93%	186.21
${}^{190}\text{Pt}$	0.01296%	
${}^{192}\text{Pt}$	0.8017%	
${}^{194}\text{Pt}$	32.934%	
${}^{195}\text{Pt}$	33.799%	195.08
${}^{196}\text{Pt}$	25.215%	
${}^{198}\text{Pt}$	7.240%	
${}^{194}\text{Pt}/{}^{195}\text{Pt} \equiv 0.9744$		

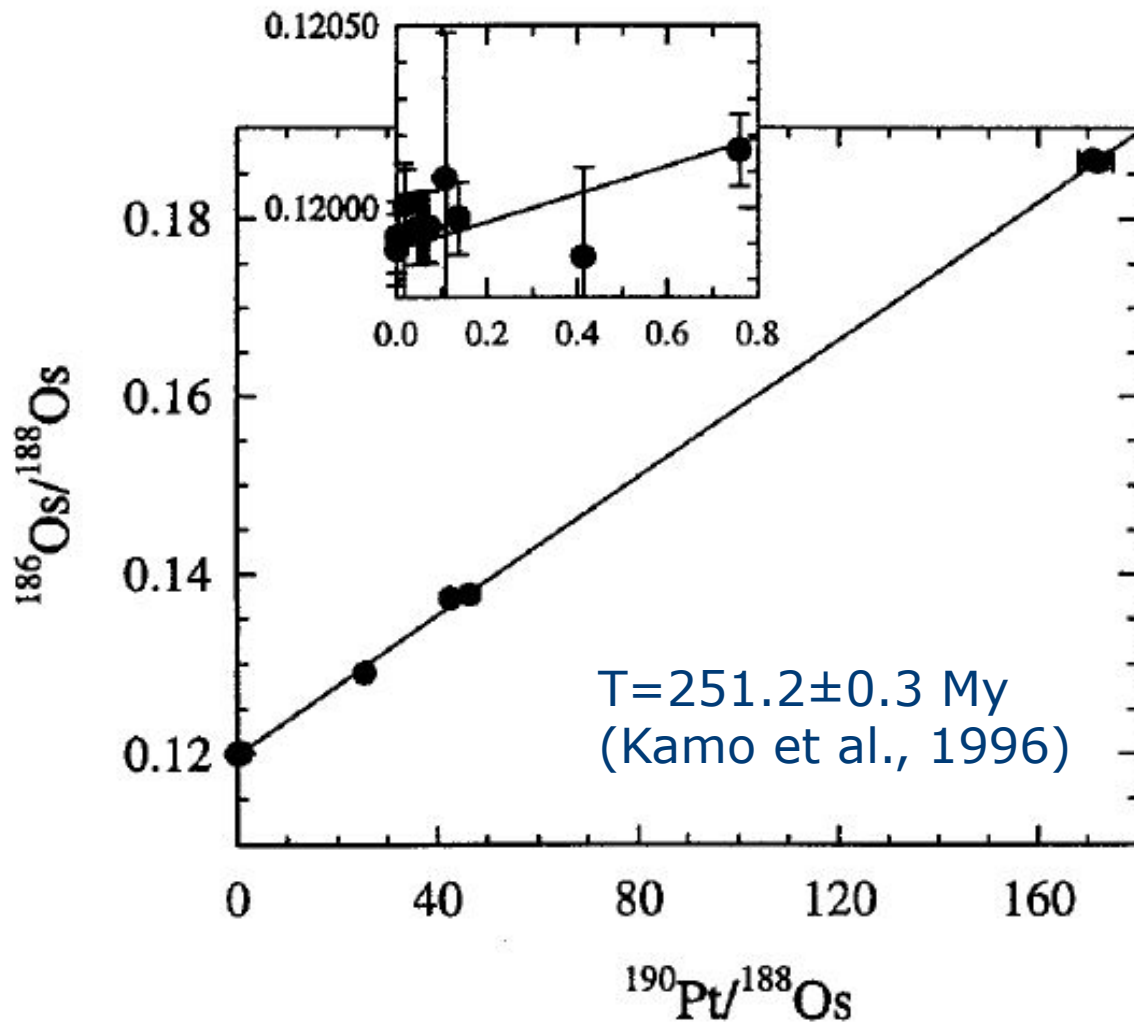


Fig. 1. $^{190}\text{Pt}/^{188}\text{Os}$ vs. $^{186}\text{Os}/^{188}\text{Os}$ for Noril'sk, Siberia ore samples. Inset shows expanded scale view of data for samples with low Pt/Os. Regression of these data gives an isochron that defines a slope of 0.0003875 ± 32 (2σ) and an intercept of 0.11981 ± 19 (2σ).

Walker R.J. et al., 1997.
 Geochimica et Cosmo-
 chimica Acta. V. 61.
 P.4799-4807.

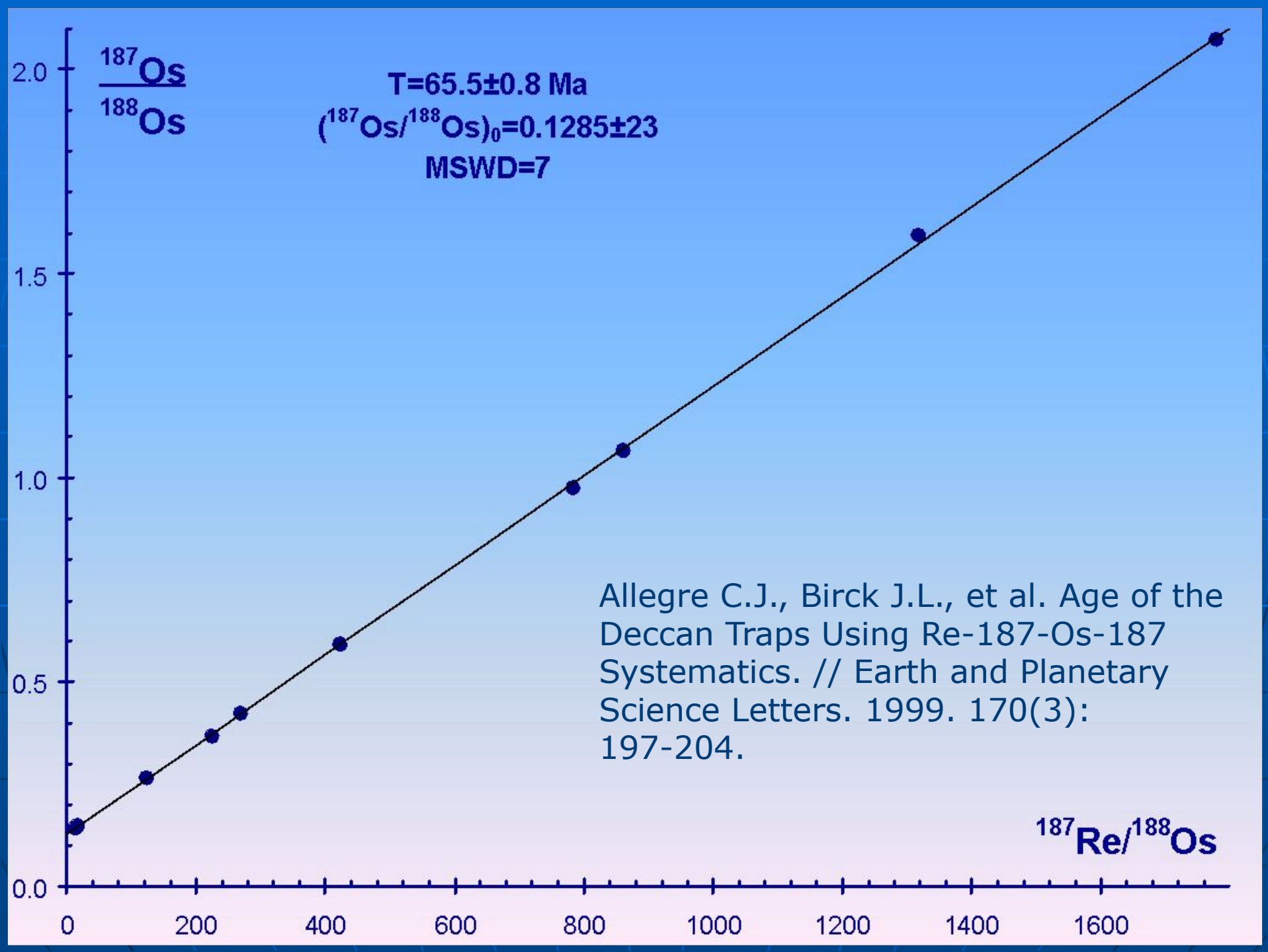
$$\left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}}\right) = \left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}}\right)_0 + \left(\frac{{}^{187}\text{Re}}{{}^{188}\text{Os}}\right) \cdot [\exp(\lambda \cdot t) - 1]$$

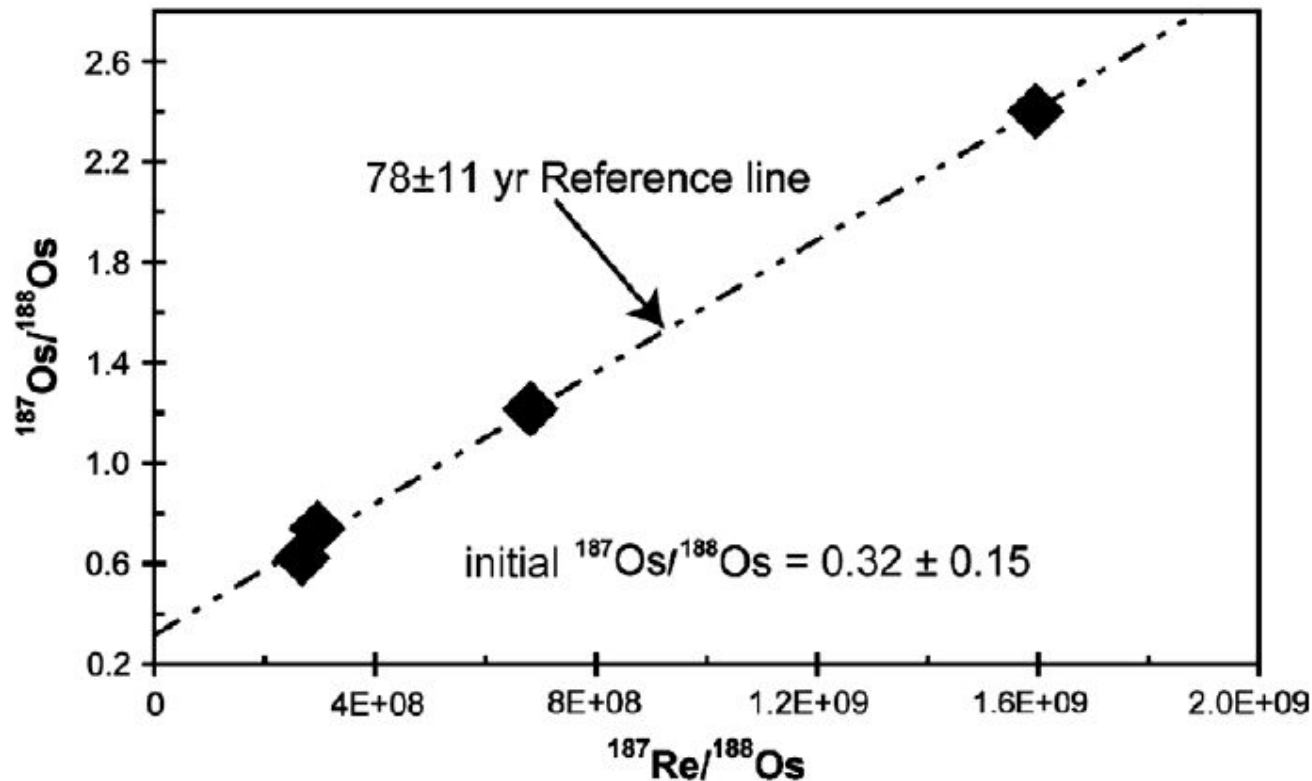
$$\gamma_{\text{Os}} = \left[\frac{\left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}}\right)_{\text{Sample}}^T}{\left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}}\right)_{\text{CHUR}}^T} - 1 \right] \cdot 100$$

$$t = \frac{1}{\lambda} \ln \left(\frac{\left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}}\right) - \left(\frac{{}^{187}\text{Os}}{{}^{188}\text{Os}}\right)_0}{\left(\frac{{}^{187}\text{Re}}{{}^{188}\text{Os}}\right)} + 1 \right)$$

М-ние	Re, %	¹⁸⁷ Os, ppm	T, Ma
Джезказган	0.110	2.4	207
Джезказган	0.056	1.2	203
Джезказган	0.023	0.52	214
Коунрад	0.084	1.7	192
Коунрад	0.075	1.5	190
Бощекуль	0.064	3.7	547
Алмалык	0.080	2.4	284
Агарак	0.042	0.19	43

Есенов Ш.Е., Егизбаева К.Е.,
 Калинин С.К., Файн Э.Е.
 Радиогенный осмий в
 ренийсодержащих рудах. //
 Геохимия. 1970. №5. С.610-615.





Повторные анализы двух образцов ренита (ReS_2) с вулкана Кудрявый (о.Итуруп).



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Cosmochimica
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Sources of unique rhenium enrichment in fumaroles and sulphides at Kudryavy volcano

Svetlana G. Tessalina ^{a,*}, Marina A. Yudovskaya ^{b,1}, Ilya V. Chaplygin ^b,
Jean-Louis Birck ^a, Françoise Capmas ^a

Jiantang Peng, Mei-Fu Zhou, Ruizhong Hu, Nengping Shen,
Shunda Yuan, Xianwu Bi, Andao Du, Wenjun Qu.

Precise molybdenite Re–Os and mica Ar–Ar dating of the Mesozoic
Yaogangxian tungsten deposit, central Nanling district, South China
Minerium Deposita (2006) 41: 661–669

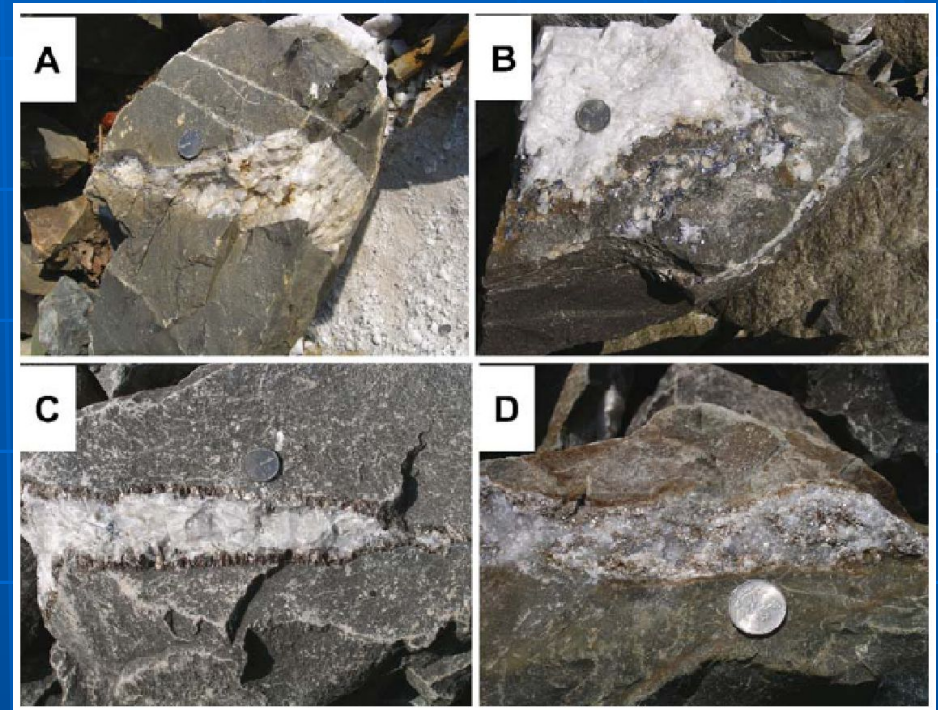
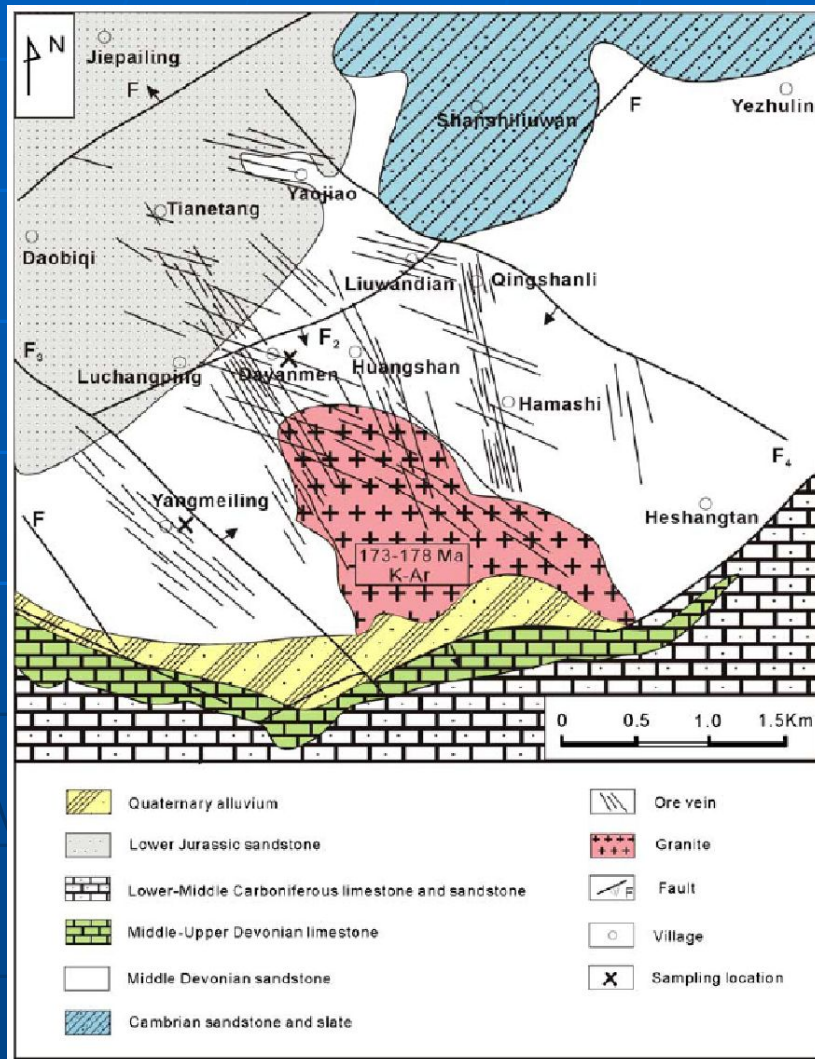


Fig. 3 Photographs of ore veins from the Yaogangxian tungsten deposit, South China.
a - Quartz–molybdenite ore vein.
b - Quartz–molybdenite ore vein.
c - Quartz–feldspar–phlogopite–sulfide vein.
d - Quartz–muscovite vein

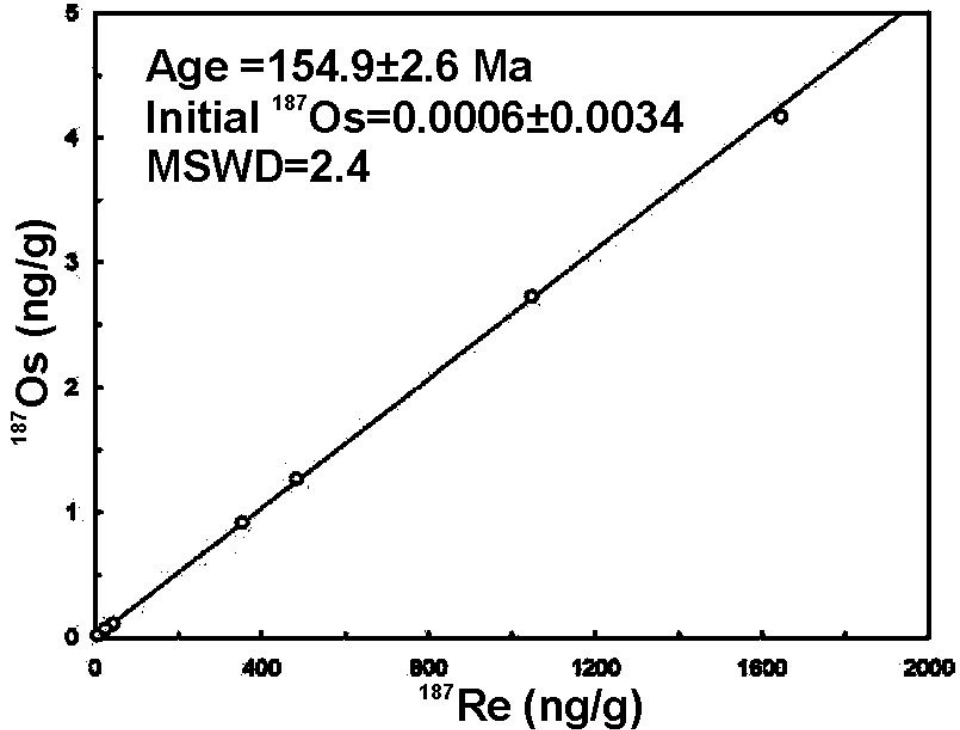


Fig. 4 ^{187}Re – ^{187}Os isochron diagram for eight molybdenite samples from the Yaogangxian tungsten deposit, South China

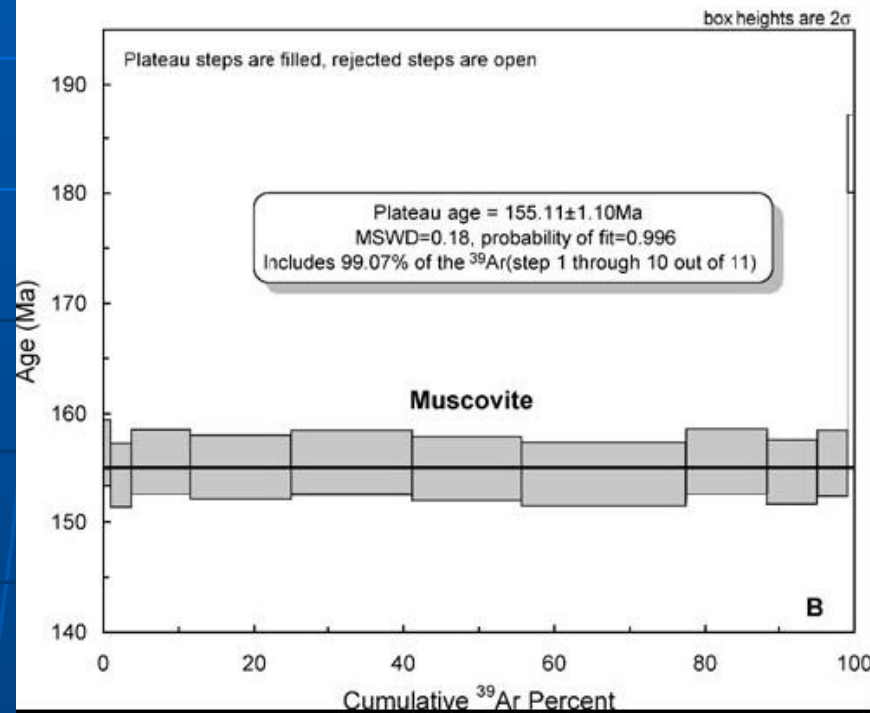
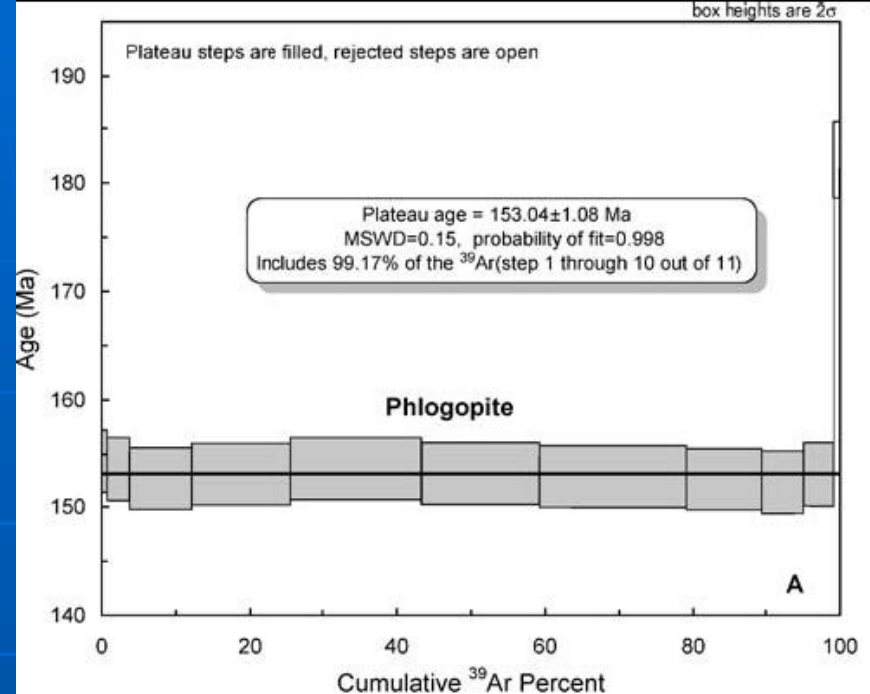


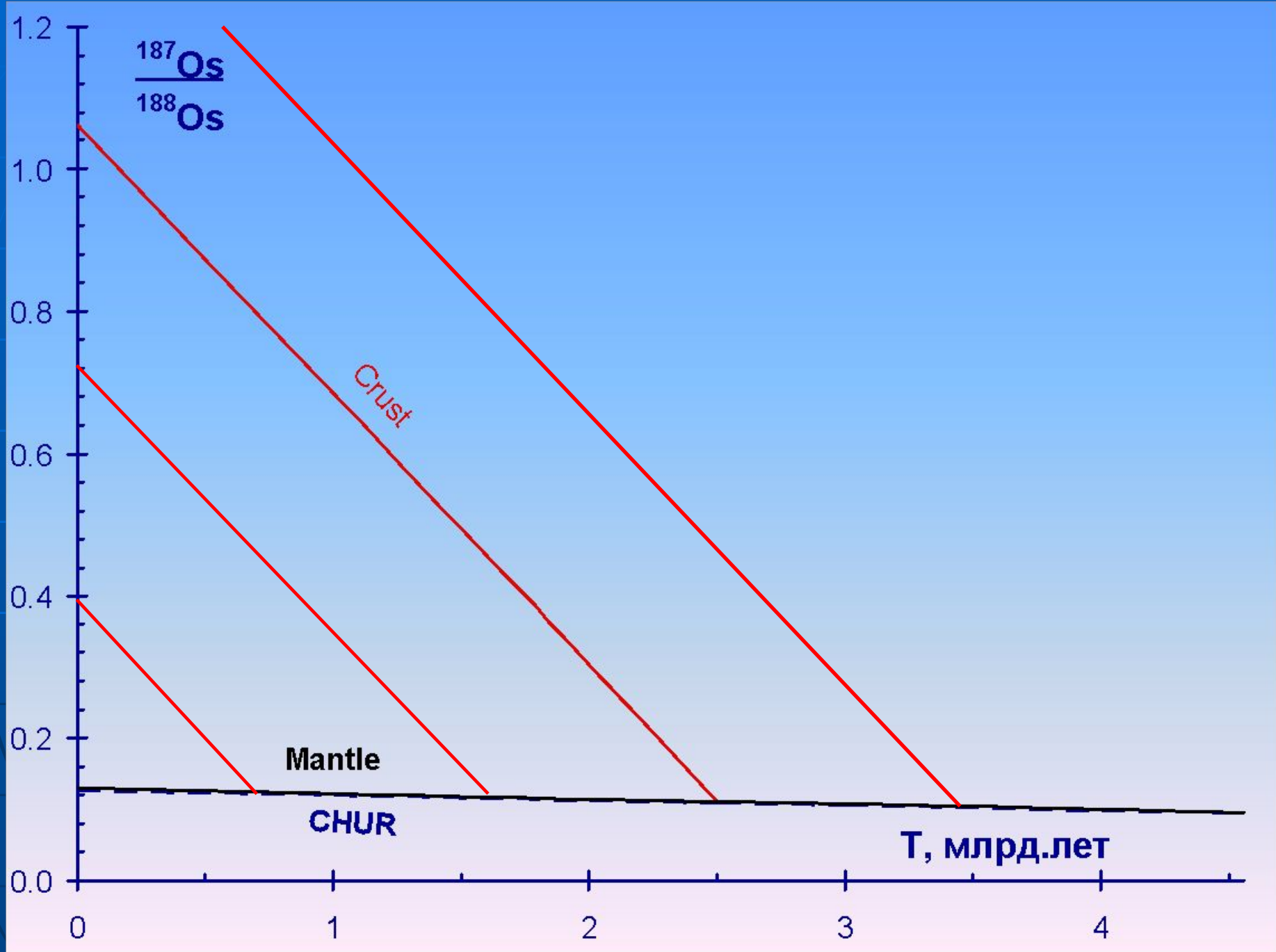
Fig. 5 $^{40}\text{Ar}/^{39}\text{Ar}$ age spectrum for phlogopite (a) and muscovite (b) from the Yaogangxian deposit, South China

Задача 19.

Рассчитать возраст молибденита, в котором обнаружены Re и Os в следующих количествах:

Вариант	Re, %	Os, ppm	Вариант	Re, %	Os, ppm
1	1.702	275.79	21	0.115	21.74
2	0.825	136.35	22	1.813	340.84
3	0.689	71.66	23	1.39	274.89
4	1.74	214.52	24	1.485	119.55
5	0.401	94.58	25	1.085	90.82
6	1.392	147.75	26	1.753	358.10
7	1.622	201.71	27	0.152	31.22
8	1.921	486.71	28	1.105	173.09
9	1.664	325.46	29	0.824	150.45
10	1.981	115.21	30	1.964	191.66
11	0.434	75.95	31	1.633	303.46
12	1.048	68.75	32	1.218	134.50
13	1.66	406.05	33	1.983	165.99
14	0.257	24.26	34	0.53	108.84
15	0.253	51.68	35	0.312	48.87
16	1.551	100.09	36	0.401	41.70
17	0.197	37.25	37	1.981	501.91
18	0.546	38.14	38	0.253	61.89
19	0.587	151.94	39	1.907	133.21
20	1.907	165.73	40	1.085	214.57

$$AW_{187Os} = 186.956$$



$\frac{^{187}\text{Os}}{^{188}\text{Os}}$

Crust

Mantle

CHUR

T, млрд.лет

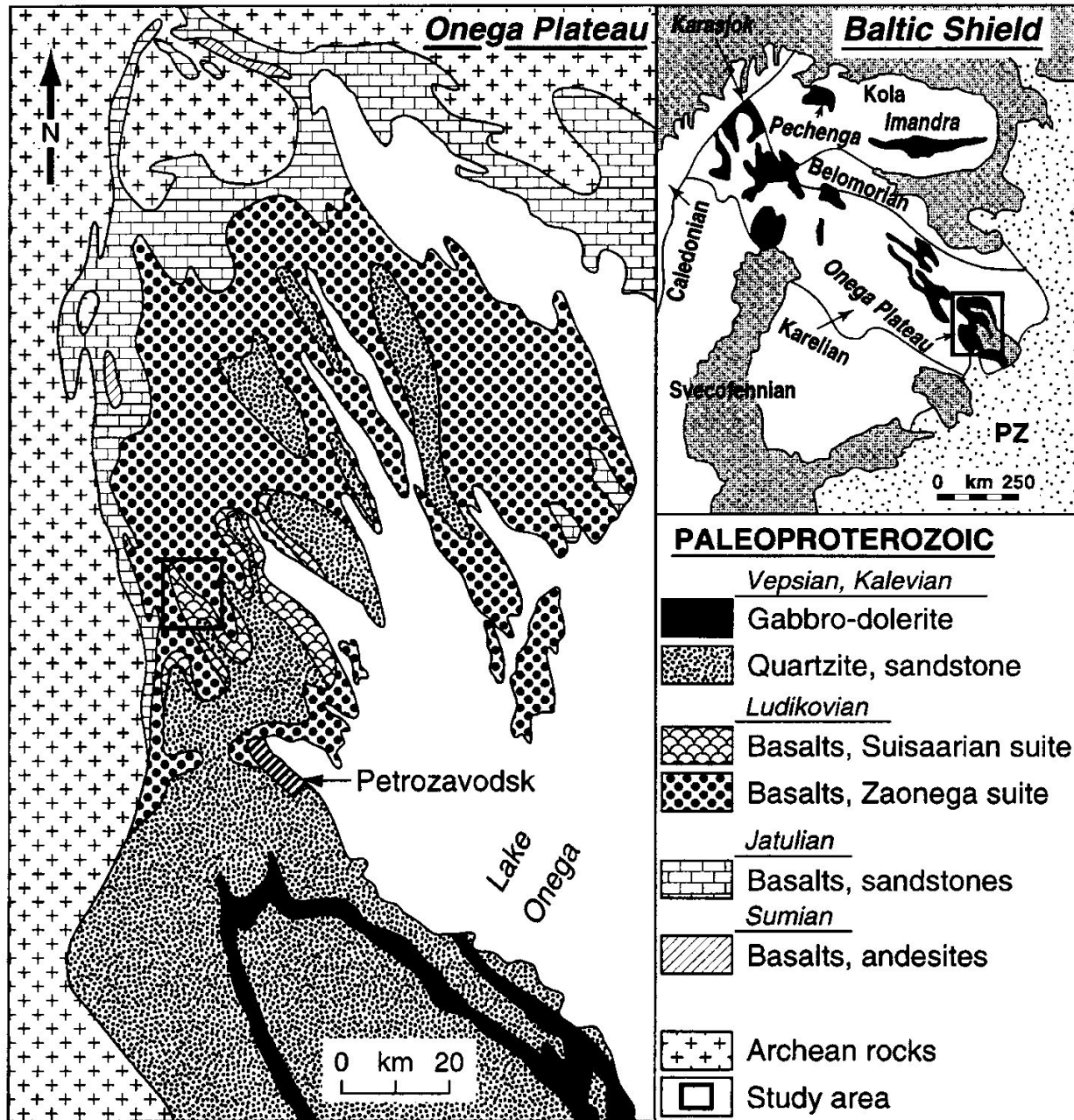


Fig. 1. Geological sketch map of the Onega plateau.

Black areas in the inset map reflect the distribution of the Jatulian and Ludikovian rocks, the remnants of the Jatulian continent.

Puchtel I.S., Brugmann G.E., et al.
Precise Re-Os Mineral Isochron and Pb-Nd-Os Isotope Systematics of a Mafic-Ultramafic Sill in the 2.0 Ga Onega Plateau (Baltic Shield). // Earth and Planetary Science Letters. 1999. 170(4): 447-461.

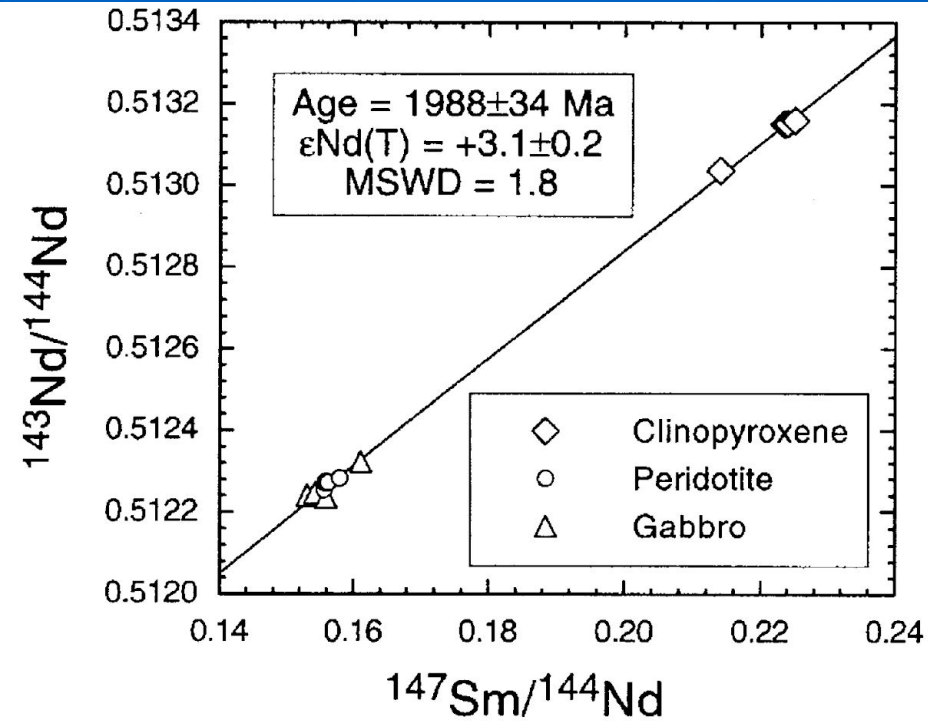


Fig. 3. Sm-Nd diagram for the Konchozero sill rocks and mineral separates.

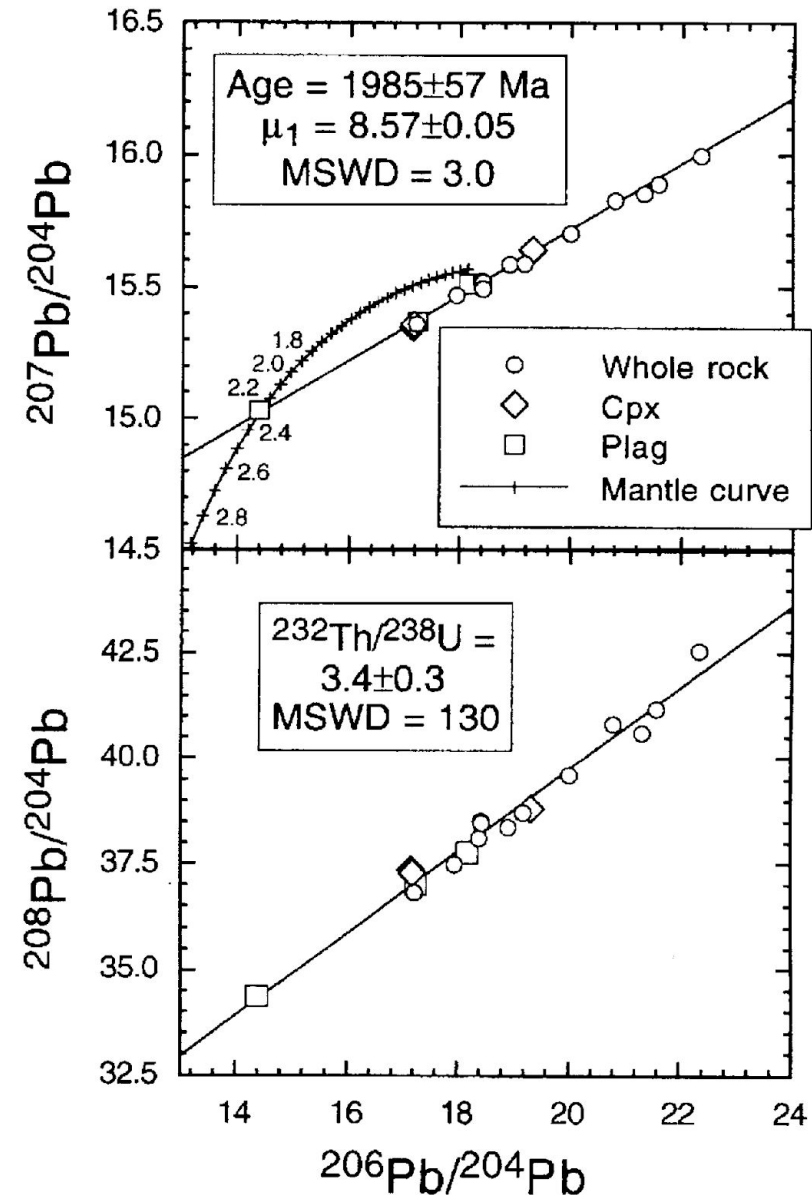


Fig. 4. Pb-Pb diagrams for the Konchozero sill rocks and mineral separates. The mantle evolution curve was drawn assuming a single-stage model, μ_1 mantle value of 8.75, 4.50 Ga as the age of the Earth and Canyon Diablo values [51] for the starting composition.

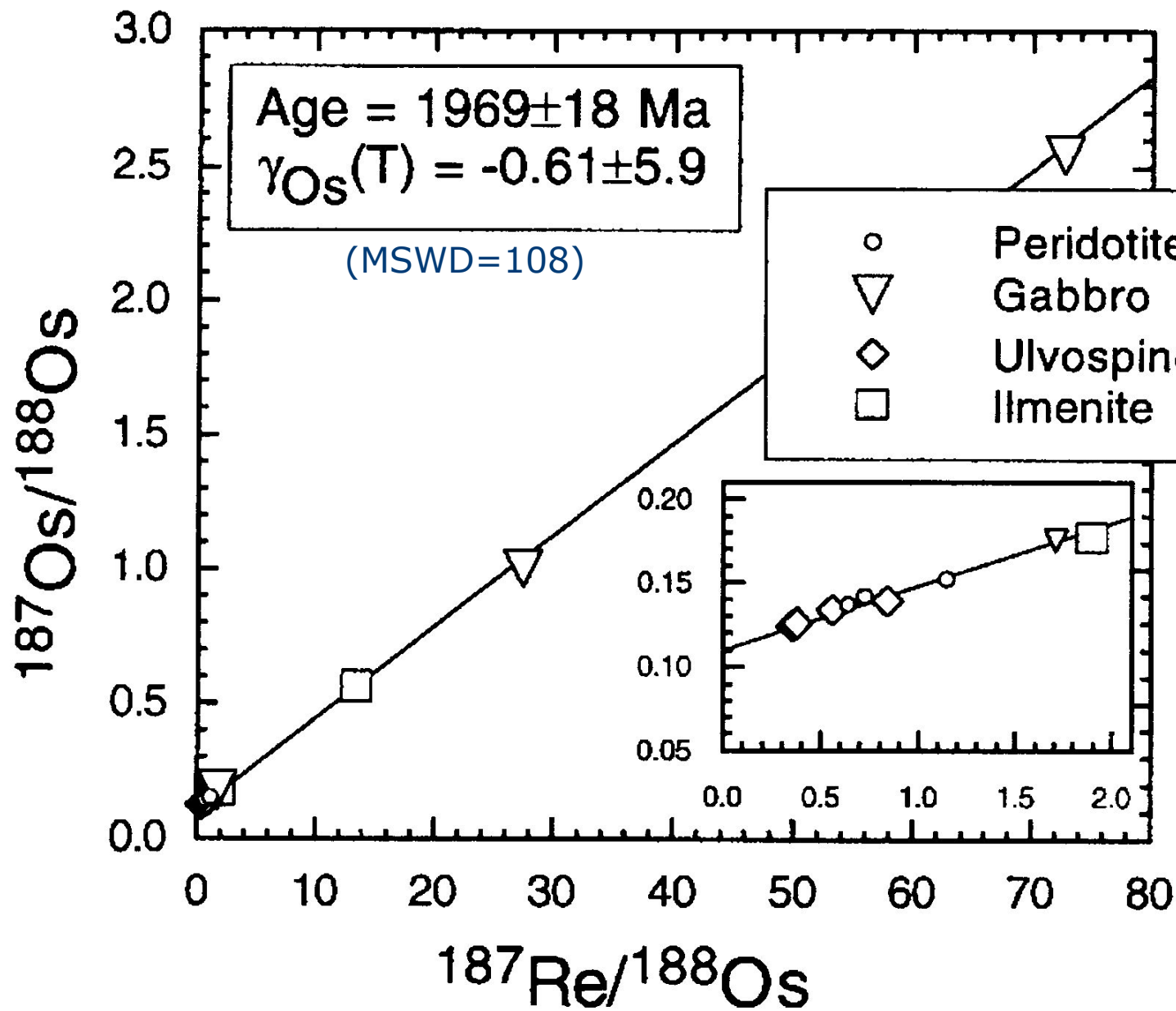


Fig. 5. Re–Os diagram for the Konchozero sill rocks and mineral separates.

Содержание Re и PGE в мантии

(PUM: Becker et al., *Geochimica et Cosmochimica Acta*. 2006. V.70. P.4528–4550)

(CI: Horan et al. *Chemical Geology*. 2003. V.196. P.5-20)

	PUM, ppb	CI, ppb	PUM/CI
Ru	7.0	652	0.0107
Rh*	1.1	130	0.0085
Pd	7.1	563	0.0126
Os	3.9	459	0.0085
Ir	3.5	456	0.0077
Pt	7.6	858	0.0089
Re	0.35	38.0	0.0092
Re/Os	0.090	0.083	1.084
Pt/Os	1.95	1.87	1.043

Задача 20.

Рассчитать современное $^{187}\text{Os}/^{188}\text{Os}$ в мантии, если Re/Os отношение в мантии на 8.4% выше хондритового, а начальные изотопные отношения осмия в этих резервуарах были одинаковые.

Uppermantle siderophile element abundances

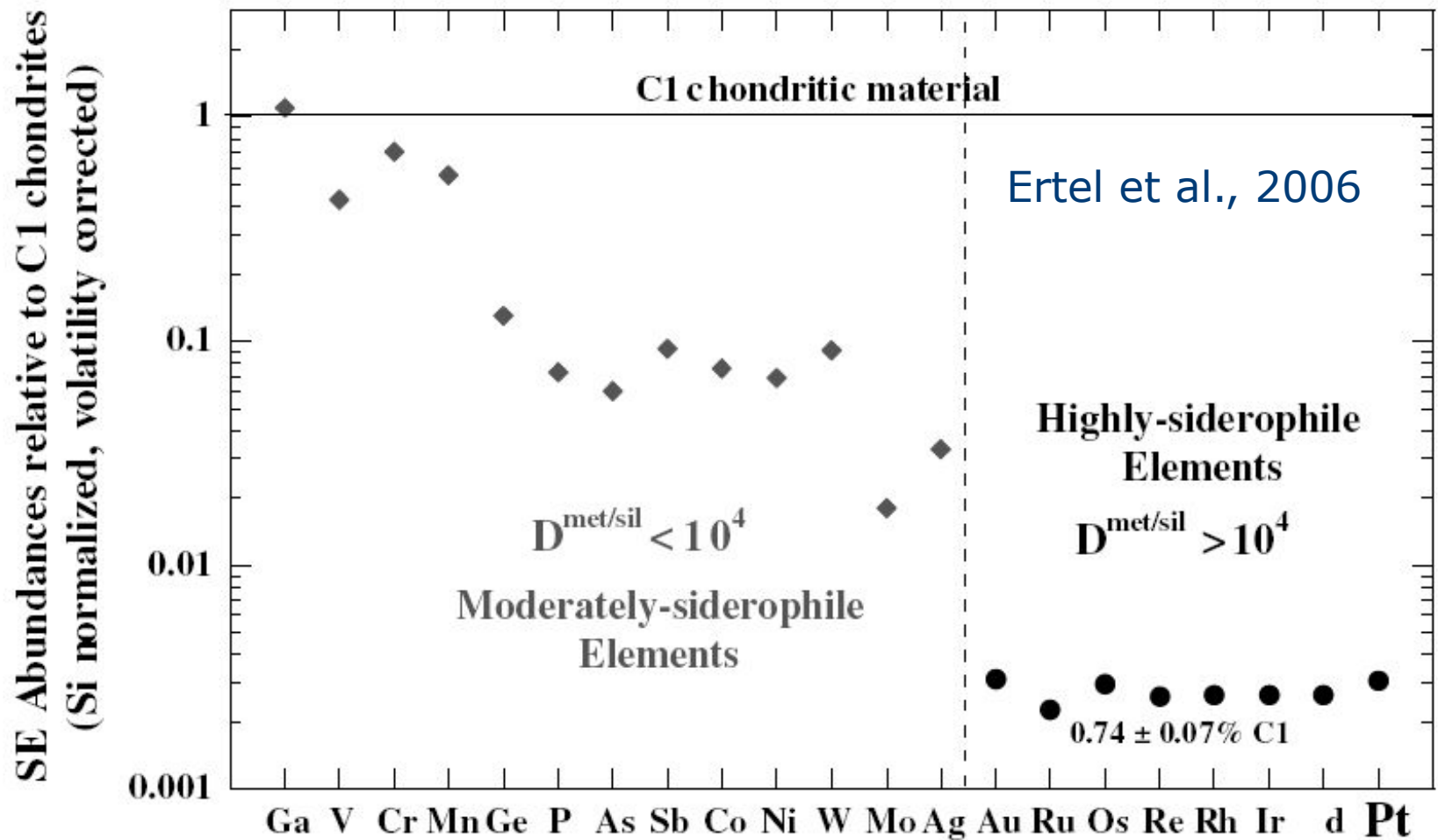
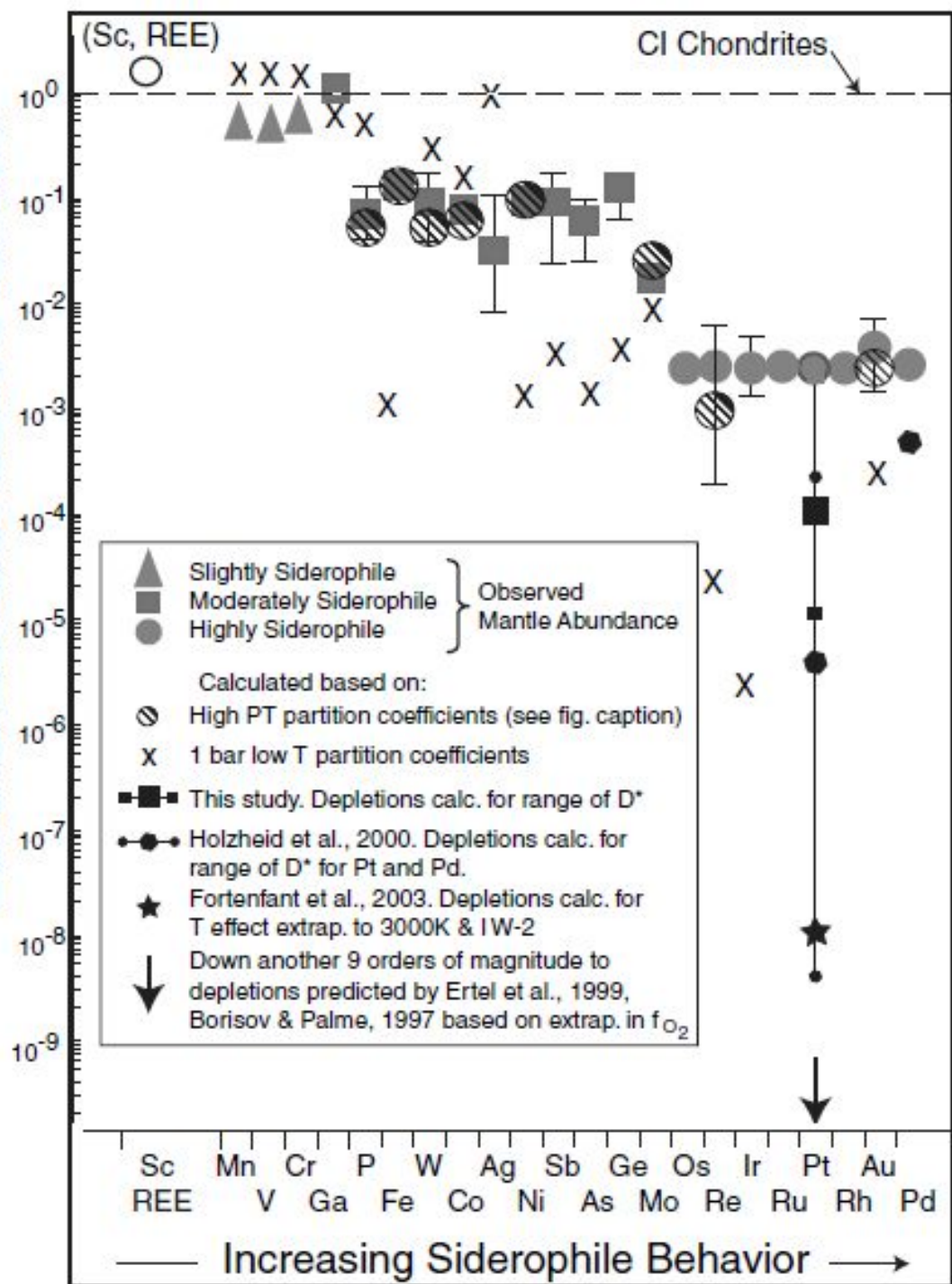


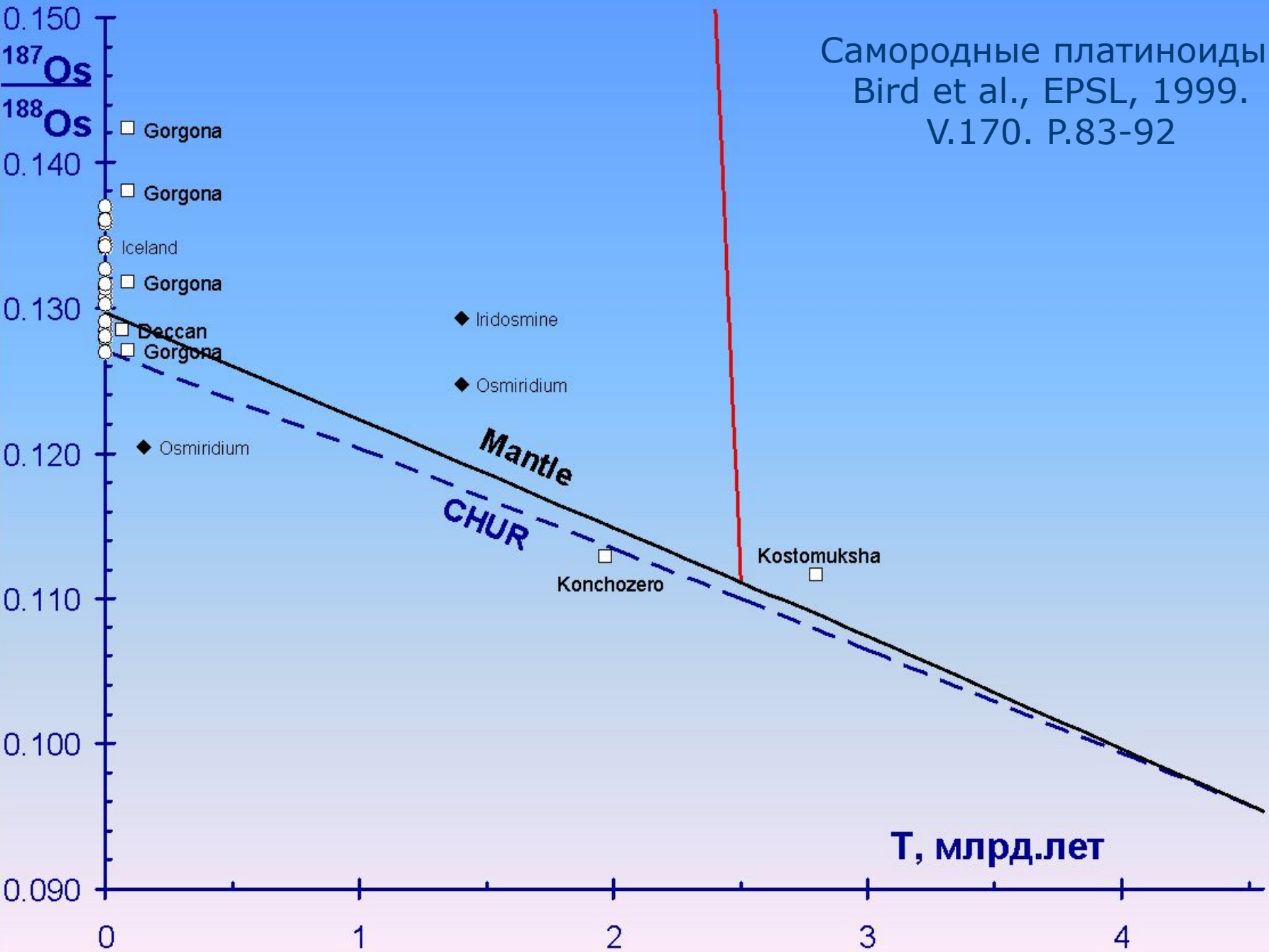
Fig. 1. Upper mantle siderophile element abundances normalized to C1 chondrites and Si (compiled from data of Newsom, 1990; McDonough and Sun, 1995; and Newsom et al., 1996; see as well Walter et al., 2000).

Elemental abundance relative to bulk Earth



E. Cottrell , D. Walker.
Geochimica et Cosmochimica
Acta .
Vol.70 (2006) p.1565–1580

Самородные платиноиды:
 Bird et al., EPSL, 1999.
 V.170. P.83-92



Задача 21.

Рассчитать модельный возраст образца иридомина относительно мантийного источника, если выделенный из него осмий имеет указанное в таблице $^{187}\text{Os}/^{188}\text{Os}$. Представить результат графически.

Вариант	$^{187}\text{Os}/^{188}\text{Os}$		Вариант	$^{187}\text{Os}/^{188}\text{Os}$
1	0.1223		21	0.1145
2	0.1216		22	0.1142
3	0.1212		23	0.1138
4	0.1209		24	0.1134
5	0.1205		25	0.1130
6	0.1201		26	0.1126
7	0.1198		27	0.1123
8	0.1194		28	0.1119
9	0.1190		29	0.1115
10	0.1186		30	0.1111
11	0.1183		31	0.1108
12	0.1179		32	0.1104
13	0.1175		33	0.1100
14	0.1172		34	0.1096
15	0.1168		35	0.1092
16	0.1164		36	0.1089
17	0.1160		37	0.1085
18	0.1157		38	0.1081
19	0.1153		39	0.1077
20	0.1149		40	0.1073

