Nd, Am and Cm isotopic measurement after simultaneous separation in transmutation irradiated samples.

Alexandre Quemet[1,*], Mathilde Angenieux[1] and Alexandre Ruas[2]

1 CEA, DES, ISEC, DMRC, Univ Montpellier, Marcoule, France

2 Division of Operations C, Department of Safeguards, International Atomic Energy Agency, Vienna International Centre, Vienna, Austria

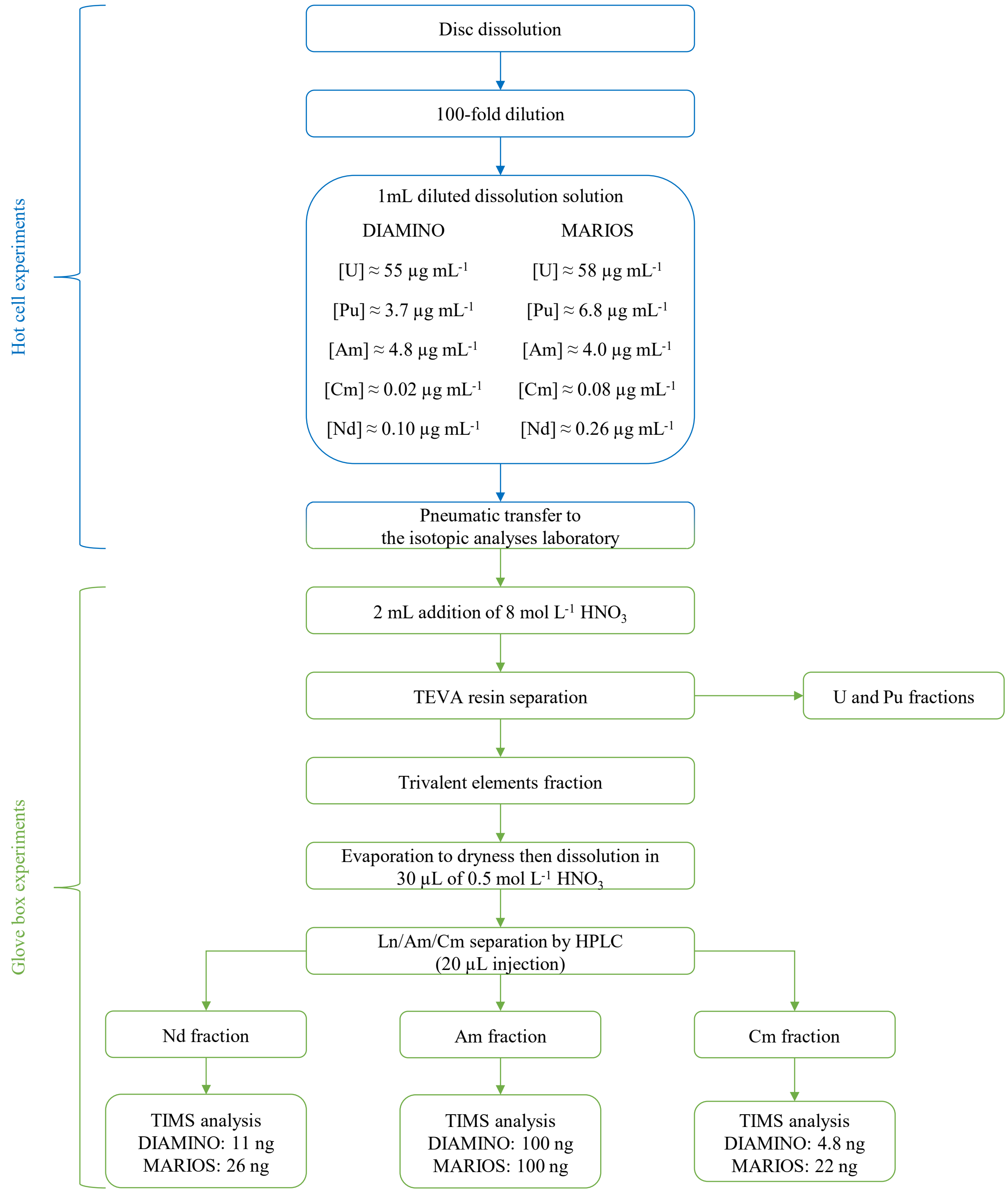

Figure S1: Schematic of the analytical protocol

Table S1. Nd isotope ratio of the JNdi-1 standard without separation. The value are compared to the data obtained by Garçon *et al*.[1] using normalization and by Wakaki *et al*.[2] using TE method without normalization. The values in parenthesis are twice the standard deviation.

	$^{142}Nd/^{144}Nd$	$^{143}Nd/^{144}Nd$	$^{145}Nd/^{144}Nd$	$^{146}Nd/^{144}Nd$	$^{148}Nd/^{144}Nd$	$^{150}Nd/^{144}Nd$
Ref. Garçon *et al.*[1]	1.141832(6)	0.512099(5)	0.348403(3)	0.7219	0.241581(3)	0.236452(6)
Ref. Wakaki *et al.*[2]	1.1391(32)	0.51158(55)	0.34890(45)	0.7234(15)	-	-
Quantity: 100ng (n=5)						
Value	1.13957(44)	0.51159(10)	0.348748(66)	0.72333(28)	0.24253(19)	0.23785(27)
RSD	0.02 %	0.01 %	0.01 %	0.02 %	0.04 %	0.06 %
Bias/Garçon *et al.*[1]	-0.20 %	-0.10 %	0.10 %	0.20 %	0.39 %	0.59 %
E_N/Garçon *et al.*[1]	10	10	11	-	10	10
Bias/Wakaki *et al.*[2]	0.04 %	0.002 %	-0.04 %	-0.01 %	-	-
E_N/Wakaki *et al.*[2]	0.3	0.03	0.7	0.1	-	-
Quantity: 10ng (n=7)						
Value	1.13945(50)	0.51156(11)	0.348771(69)	0.72343(28)	0.24260(19)	0.23794(30)
RSD	0.01 %	0.01 %	0.01 %	0.01 %	0.04 %	0.06 %
Bias/Garçon *et al.*[1]	-0.21 %	-0.10 %	0.11 %	0.21 %	0.42 %	0.63 %
E_N/Garçon *et al.*[1]	10	10	11	-	11	10
Bias/Wakaki *et al.*[2]	0.03 %	-0.004 %	-0.04 %	0.004 %	-	-
E_N/Wakaki *et al.*[2]	0.2	0.1	0.6	0.04	-	-
Quantity: 1ng (n=14)						
Value	1.1399(13)	0.51157(37)	0.34873(19)	0.72339(83)	0.24258(56)	0.23788(77)
RSD	0.06 %	0.04 %	0.03 %	0.06 %	0.11 %	0.16 %
Bias/Garçon *et al.*[1]	-0.17 %	-0.10 %	0.09 %	0.21 %	0.41 %	0.60 %
E_N/Garçon *et al.*[1]	3.1	2.9	3.5	-	3.6	3.7
Bias/Wakaki *et al.*[2]	0.07 %	-0.01 %	-0.04 %	0.003 %	-	-
E_N/Wakaki *et al.*[2]	0.4	0.03	0.7	0.01	-	-
All the values (n=26)						
Value	1.1397(11)	0.51157(28)	0.34874(15)	0.72339(63)	0.24258(43)	0.23789(59)
RSD	0.05 %	0.03 %	0.02 %	0.04 %	0.09 %	0.12 %
Bias/Garçon *et al.*[1]	-0.19 %	-0.10 %	0.10 %	0.21 %	0.41 %	0.61 %
E_N/Garçon *et al.*[1]	4.1	3.8	4.7	-	4.7	4.9
Bias/Wakaki *et al.*[2]	0.05 %	-0.00002 %	-0.04 %	-0.001 %	-	-
E_N/Wakaki *et al.*[2]	0.4	0.03	0.7	0.01	-	-

Table S2. Nd isotope ratio of the JNdi-1 standard without separation using the conventional normalization ($^{146}Nd/^{144}Nd$ = 0.7219). The values are compared to the data obtained by Garçon *et al.*[1] The values in parenthesis are twice the standard deviation.

	$^{142}Nd/^{144}Nd$	$^{143}Nd/^{144}Nd$	$^{145}Nd/^{144}Nd$	$^{146}Nd/^{144}Nd$	$^{148}Nd/^{144}Nd$	$^{150}Nd/^{144}Nd$
Ref. Garçon *et al.*[1]	1.141832(6)	0.512099(5)	0.348403(3)	0.7219	0.241581(3)	0.236452(6)
Quantity: 100ng (n=5)						
Value	1.141860(34)	0.512101(13)	0.3484022(34)	0.7219	0.2415816(21)	0.2364564(67)
RSD	0.001 %	0.001 %	0.0005 %	-	0.0004 %	0.001 %
Bias	0.002 %	0.0003 %	-0.0002 %	-	0.0003 %	0.002 %
E_N	1.6	0.2	0.4	-	0.3	1.0
Quantity: 10ng (n=7)						
Value	1.141898(79)	0.512108(16)	0.348402(19)	0.7219	0.241580(13)	0.236458(27)
RSD	0.003 %	0.002 %	0.003 %	-	0.003 %	0.006 %
Bias	0.006 %	0.002 %	-0.0004 %	-	-0.001 %	0.002 %
E_N	1.7	1.1	0.2	-	0.003 %	0.006 %
Quantity: 1ng (n=14)						
Value	1.14225(79)	0.51210(16)	0.348367(50)	0.7219	0.241590(82)	0.236430(78)
RSD	0.01 %	0.01 %	0.01 %	-	0.02 %	0.02 %
Bias	0.04 %	0.001 %	-0.01 %	-	0.004 %	-0.01 %
E_N	3.0	0.1	1.5	-	0.2	0.6
All the values (n=26)						
Value	1.14208(43)	0.512104(86)	0.348383(52)	0.7219	0.241586(60)	0.236442(64)
RSD	0.02 %	0.01 %	0.01 %	-	0.01 %	0.01 %
Bias	0.02 %	0.001 %	-0.01 %	-	0.002 %	-0.004 %
E_N	1.2	0.1	0.8	-	0.2	0.3

Table S3: Nd, Am and Cm isotope ratios for DIAMINO and MARIOS discs and estimated by the neutronic simulation for DIAMINO disc. The values in parenthesis are the uncertainties at k = 2.

Isotope ratio	DIAMINO disc	DIAMINO neutronic simulation	MARIOS disc
Nd isotope ratio			
$^{142}Nd/^{145}Nd$	0.0180(72)	0.0057	0.0128(37)
$^{143}Nd/^{145}Nd$	1.2877(15)	1.2	1.2860(14)
$^{144}Nd/^{145}Nd$	1.3840(77)	1.4	1.4086(67)
$^{146}Nd/^{145}Nd$	0.8562(21)	0.84	0.8992(14)
$^{148}Nd/^{145}Nd$	0.5705(17)	0.56	0.5892(17)
$^{150}Nd/^{145}Nd$	0.3445(21)	0.31	0.3626(16)
Am isotope ratio			
$^{242m}Am/^{241}Am$	0.01164(21)	0.0061	0.02173(36)
$^{243}Am/^{241}Am$	0.016730(22)	0.024	0.061149(93)
Cm isotope ratio			
$^{242}Cm/^{244}Cm$	<0.60	0.53	<0.10
$^{243}Cm/^{244}Cm$	3.167(69)	2.1	1.314(28)
$^{245}Cm/^{244}Cm$	0.00821(80)	0.014	0.0451(12)
$^{246}Cm/^{244}Cm$	<0.020	0.001	0.0024(12)
$^{247}Cm/^{244}Cm$	<0.020	$<2.10^{-6}$	<0.0050
$^{248}Cm/^{244}Cm$	<0.020	$<2.10^{-6}$	<0.0050

Reference

(1) Garçon, M.; Boyet, M.; Carlson, R. W.; Horan, M. F.; Auclair, D.; Mock, T. D. Factors Influencing the Precision and Accuracy of Nd Isotope Measurements by Thermal Ionization Mass Spectrometry. *Chem. Geol.* **2017**, *476* (November 2017), 493–514. https://doi.org/10.1016/j.chemgeo.2017.12.003.

(2) Wakaki, S.; Shibata, S.-N.; Tanaka, T. Isotope Ratio Measurements of Trace Nd by the Total Evaporation Normalization (TEN) Method in Thermal Ionization Mass Spectrometry. *Int. J. Mass Spectrom.* **2007**, *264* (2), 157–163. https://doi.org/10.1016/j.ijms.2007.04.006.