Supplement of Solid Earth, 7, 11–36, 2016
http://www.solid-earth.net/7/11/2016/
doi:10.5194/se-7-11-2016-supplement

Supplement of

The Imbert Formation of northern Hispaniola: a tectono-sedimentary record of arc–continent collision and ophiolite emplacement in the northern Caribbean subduction–accretionary prism

J. Escuder-Viruete et al.

Correspondence to: J. Escuder-Viruete (j.escuder@igme.es)

Description of facies associations in the Imbert Formation

Code	*Dominant facies types*	*Features (grain size, grading/fabric/clast orientation)*	*Flow type*	*Interpretation of depositional environment*
Os	Lensoidal serpentinite blocks in a heterogeneous and mostly deformed matrix composed of shale, mudstone and sandstone	Blocks randomly distributed in a polymictic brecciated matrix. Blocks of mainy peridotite/serpentinite nature (exotic) but also intra-basinal (not-exotic). Block of few centimeters to several meters in size (rarely tens of meters). Blocks and clasts are angular and of similar nature than in Gm (RSJC). Abundant serpentinite particles of sand size. Structureless silts and muds.	Gravity-driven mass-transport processes (debris flows, debris avalanches, slumps, block slides, etc.) and hyper-concentrated flows. Bands of normal brittle shearing	Slope facies to foreland facies. Mass transport deposits at the wedge front
Gm	Massive breccia and matrix-supported, muddy-sandy (polymictic) conglomerate	Desorganized internal structure, pebble to cobble size, ungraded, often erosive base, random clast orientation. Clasts of (mainly) serpentinite, red/green volcanic rocks, laminated sandstone, feldspar grains, (rare) white limestone and red and green mundstones (rip-up clasts). In the RSJC clasts of ferruginized volcanic rocks, red microbreccia, porphyritic lavas, isotropic gabbros and dolerites also occur. Often lenticular beds with erosive base, deformed by syn-sedimentary extensional faulting	Non-cohesive debris flow	Larger channel deposits within submarine fan systems, relatively stable in position, probably served as major sediment conduits to basin. Slumping processes
Gp	Clast-supported, sandy (polymictic) breccia and conglomerate	Inverse-to-normally graded internal structure, clast-supported fabric, angular clasts of sand to pebble grain-size, random clast orientation. Massive internal structura also occur. Often lenticular beds with erosive base, deformed by syn-sedimentary extensional faulting . Interbedded pebby conglomerate and coarse-grained sandstone	Non-cohesive debris flow transitional to cohesive debris flows?, postdepositional fluidization effects	Channel deposits within submarine fans, possibly less stable in position than Gm. Rare associated overbank/levee deposits. Slumping processes
Sc	Medium-to-thick bedded coarse-grained sandstone and microconglomerates	Parallel-stratified sandstones. Organized internal structure (Bouma-sequences Ta or Tb) or massive. Sand (coarse-to-granule) grain size. Internal normally graded. Often horizontal-lamination, rare argillite pebbles at base. Intercalations of Gn facies conglomerates and microconglomerates	High-concentration turbidity currents. Post-depositional liquefaction	Undifferentiated lobe or channel fill facies. Slumping
Sm	Thin-bedded, medium-to-fine-grained sandstone	Parallel-stratified sandstones. Organized internal structure (Bouma-sequences Tb or Tc) or massive. Silt-sand grain size. Sandstone/mudstone ratios of 40-75% sandstone	Turbidity currents	More proximal lobe-fringe or levee/overbank facies. Slumping
Sf	Fine-grained sandstone, siltstone and laminated mudstone	Alternating fine-grained sandstone-mudstone sequence. Sand-mud couplets and muddy sands, 20-80% sand grade, <80% mud grade. Often organized internal structures. Silt-sand grain size. Graded-stratified silt. Thin regular silt and mud laminae.	Turbidity currents	Distal lobe facies. Slumping in upper stratigraphic levels
Ms (RSJC)	Massive variocolored mundstone-mundslate with clasts and blocks (of Gm)	>80% mud, <30% silt, 0-20% sand of serpentinitic composition. Disorganized internal structures. Caotically disposed <60% cobble to boulder angular to subrounded blocks of serpentinite, beig sandstone, green mundstone. Structureless or banded red, green and grey muds		
Tv	Fine-grained tuff with alternating fine-grained tuffaceous sandstone-mudstone	White, cream and turquoise coloured tuff. Rare laminated internal structure in tuff. Fine-grained size in sands. Structureless silts and muds. Alternating thin-bedded, fine-grained tuffaceous sandstone-mudstone sequence	Dilute turbidity currents and volcanic particle fall	Very distal lobe and basin plain facies.
Lc (RSJC)	White coarse-grained calcarenites	White shelfal-derived calcarenites and bio-calcarenites (intra-basinal) and green serpentinite clasts (extra-basinal elements). Medium to coarse-grained size	Turbidity currents	

Bulk rock major and trace element compositions of studied samples from the Imbert Fm

X	-70,812	-70,812	-70,809	-70,829	-70,812	-70,812	-70,812
Y	19,758	19,758	19,753	19,778	19,758	19,758	19,758
Rock	dyke	dyke	sill	sill	basalt	basalt	dolerite
Sample	10JE222	10JE222B	11JE15	13JE27	13JE30A	13JE30B	13JE30C
SiO2	52,91	52,87	51,48	49,19	52,05	52,16	43,54
TiO2	1,17	1,17	1,26	0,68	1,24	1,22	0,43
Al2O3	15,43	15,55	16,24	14,77	15,50	15,31	9,85
Fe2O3	11,27	11,17	11,23	8,70	11,55	11,61	4,20
MgO	3,22	3,22	3,67	6,63	3,19	3,09	1,59
CaO	6,48	6,46	8,74	6,81	6,36	6,32	19,31
Na2O	3,43	3,48	3,18	2,32	3,45	3,39	1,77
K2O	1,49	1,49	1,10	0,87	1,29	1,32	1,62
P2O5	0,22	0,22	0,18	0,12	0,22	0,22	0,11
MnO	0,20	0,20	0,18	0,13	0,20	0,18	0,36
Cr2O3	0,00	0,00	0,00	0,02	0,00	0,00	0,03
LOI	3,90	3,90	2,50	9,60	4,70	5,00	17,00
SUM	99,77	99,77	99,78	99,84	99,77	99,77	99,84
Mg#[a]	36	36	39	60	35	35	43
Cr	3,4	6,8	6,8	116,3	6,8	6,8	225,8
Co	26,20	26,50	27,10	24,60	26,20	24,90	11,70
Ni	5,40		5,80	69,30	5,20	4,90	66,10
V	354	360	385	224	369	359	98
Rb	19,00	18,80	16,60	10,00	13,30	12,30	16,90
Ba	256	262	204	276	236	273	487
Th	2,10	2,20	1,50	1,00	1,80	1,60	1,00
U	0,90	0,90	0,80	0,40	0,70	1,00	0,40
Nb	2,50	2,40	1,70	2,50	2,30	2,30	2,00
Ta	0,40	0,20	0,17	0,21	0,19	0,19	0,17
La	10,40	10,80	8,80	6,70	10,60	11,50	6,50
Ce	27,10	27,20	21,60	14,00	25,30	24,80	11,30
Pb	5,30	4,60	28,70	11,70	3,90	2,70	2,20
Pr	4,12	4,14	3,42	1,91	3,81	3,92	1,70
Sr	253,6	256,6	286,8	192,3	280,1	268,9	362,9
Nd	19,80	20,10	16,80	8,10	19,00	18,90	7,80
Sm	5,25	5,58	4,50	2,08	5,01	4,95	1,86
Zr	148,5	150,1	129,3	58,8	141,9	135,0	61,1
Hf	4,50	4,50	3,60	1,60	4,10	4,10	1,50
Eu	1,43	1,47	1,33	0,68	1,43	1,34	0,59
Gd	5,52	5,63	4,69	2,37	5,39	5,77	2,10
Tb	0,98	1,01	0,76	0,42	0,92	0,97	0,35
Dy	6,12	5,97	4,75	2,42	5,28	5,49	2,07
Y	34,2	33,8	28,5	14,0	31,3	29,9	11,7
Ho	1,25	1,30	0,98	0,55	1,15	1,20	0,43
Er	3,71	3,75	2,97	1,75	3,34	3,38	1,31
Tm	0,58	0,58	0,47	0,25	0,51	0,53	0,21
Yb	3,68	3,67	2,93	1,71	3,39	3,27	1,32
Lu	0,56	0,56	0,45	0,23	0,52	0,49	0,21

Major elements in wt.%; trace elements in ppm.

[a] Mg# = 100 * mol MgO/ mol (FeO + MgO); for Fe2O3/FeO = 0.2. Total Fe as Fe2O3.

Results of the paleostress analysis in the Imbert Formation

Outcrop[a]	*Lithology*	Numbe	σ1[b]	Eigenvalue	σ2	Eigenvalue	σ3	Eigenvalue	*R*
11JE11	*IM2 unit, PPC*	36	14,1;12,5	0,325	237,1;73,2	0,305	106,6;11,1	0,019	0,94
11JE15	*IM2 unit, PPC*	20	107,9;72,4	0,212	319,8;15,1	0,161	227,4; 08,9	0,050	0,69
10JE224	*IM2 unit, PPC*	22	20,5; 08,5	0,274	191,5; 81,4	0,187	290,3; 01,3	0,087	0,54
10JE224B	*IM2 unit, PPC*	12	98,1; 70,7	0,345	341,3; 08,9	0,338	248,6; 16,9	0,007	0,98
10JE225	*IM2 unit, PPC*	25	108,4; 76,7	0,262	207,9;02,2	0,220	298,5;13,1	0,043	0,81
10JE225B	*IM2 unit, PPC*	12	112,5; 67,9	0,354	208,9; 02,6	0,318	300,0;21,9	0,036	0,89
11JE51	*IM3 unit, RSJC*	20	322,4;82,1	0,322	126,8;8,6	0,294	212.6;14,8	0,094	0,88
10JE252	*IM3 unit, RSJC*	32	73,4; 34,9	0,343	215,4; 48,5	0,237	329,1; 19,6	0,107	0,55
10JE252B	*IM3 unit, RSJC*	12	29,8; 82,4	0,328	231,3;07,1	0,222	141,0;02,8	0,102	0,53

[a] All data rotated by unfold the average bedding plane

[b] The values of sigma correspond to two angles (in degrees), the first one being the trend of stress axis and the second one being its plunge.

Trends and plunges of axes of paleostress tensors deduced from the inversion of orientation and striae of faults
using FaultKin software (Marret and Almendinger, 1990)

R, axial ratio, (σ2-σ3)/(σ1-σ3)

Summary of ^{40}Ar-^{39}Ar incremental heating experiments of mineral separates

10JE54 Plagioclase *(sample/mineral)*

Laser	*Isotope Ratios*										
Power(%)	*40Ar/39Ar*	*2s*	*36Ar/40Ar*	*2s*	*r.i.*	*Ca/K*	*%40Ar atm*	*f 39Ar*	*40Ar*/39A*	*Age*	*2s*
2,3	125,508	4,635	0,331	0,015	0,013	0,802	91,033	6,296	11,257	57,529	33,025
3,2	29,374	0,543	0,065	0,003	0,093	8,360	74,259	32,249	7,585	38,965	9,131
3,5	18,838	0,400	0,027	0,002	0,105	3,374	49,093	17,636	9,602	49,185	7,508
3,9	19,268	0,165	0,033	0,002	0,054	2,489	58,027	10,302	8,095	41,554	6,719
4,5	23,247	0,427	0,046	0,003	0,025	2,643	68,229	13,626	7,393	37,988	8,756
5,5	24,884	0,481	0,046	0,002	0,067	4,822	63,239	11,807	9,165	46,973	5,453
7	24,154	0,753	0,047	0,003	0,037	7,312	65,324	8,083	8,399	43,096	11,428

J = 0.00287150 ± 0.00000574 Volume 39A 0,021062 x E-13 cm3 NPT
Integrated Date = 44,041456 3,0551387 Ma
Plateau age = 44.0 ± 3.1 Ma (2s, including J-error of MSWD = 1.2, probability=0.28 Includes 100% of the 39A steps 1 through 7
Inverse isochron (correlation age) results, plateau steps: Model 1 Solution (±95%-conf.) on 7 points
Age = 42.8 ± 5.3 Ma Initial 40Ar/36Ar =350 ± 20 MSWD = 1.5 Probability = 0.15

JM9112 Plagioclase *(sample/mineral)*

Laser	*Isotope Ratios*											
Power(%)	*40Ar/39Ar*	*1σ*	*37Ar/39Ar*	*1σ*	*36Ar/39Ar*	*1σ*	*Ca/K*	*%40Ar atm*	*f 39Ar*	*40Ar*/39ArK*	*Age*	*2 σ*
2,00 W	621,48	32,76	46,61	2,96	2,114	0,124	88,26	99,92	0,16	0,519	5,20	± 357,01
2,20 W	114,42	1,91	14,70	0,38	0,391	0,011	27,20	99,92	4,27	0,093	0,94	± 52,71
2,40 W	98,52	1,04	18,69	0,36	0,329	0,008	34,70	97,03	7,86	2,964	29,51	± 43,73
2,70 W	71,43	0,70	79,08	1,44	0,247	0,006	153,39	93,09	13,55	5,225	51,71	± 32,66
3,00 W	21,64	0,25	77,74	1,43	0,083	0,002	150,65	83,76	7,06	3,720	36,96	± 15,25
3,40 W	15,34	0,21	36,62	0,75	0,052	0,002	68,86	80,82	8,06	3,022	30,08	± 12,10
4,00 W	9,75	0,08	14,80	0,26	0,028	0,001	27,39	71,15	38,66	2,841	28,30	± 5,00
4,80 W	23,44	0,27	43,13	0,81	0,077	0,002	81,47	81,46	11,40	4,482	44,45	± 11,82
5,80 W	24,38	0,20	51,25	0,92	0,077	0,002	97,39	76,43	5,23	5,962	58,89	± 11,28
6,80 W	32,21	0,34	64,29	1,21	0,109	0,004	123,34	84,01	3,76	5,394	53,36	± 21,18

J = 0.0055517 ± 0.0000278 Volume 39Ar 0,095 Integrated Dat 35,54 ± 6,76 Ma
Plateau Age = 29.5 ± 4.3 Ma (2s, including J-error of .3 MSWD = 0.71, probability=0.64 79.6% of the 39Ar, steps 1 through 7
Inverse isochron (correlation age) results, plateau steps: Model 1 Solution (±95%-conf.) on 10 poi Age = 34 ± 13 Ma
40/36 intercept: 300 ± 18, MSWD = 3.8, Probability = 0.002 (at J=.0055517±.3% 2s)

HH9124 Hornblende *(sample/mineral)*

Laser *Isotope Ratios*

Power(%)	*40Ar/39Ar*	*1σ*	*37Ar/39Ar*	*1σ*	*36Ar/39Ar*	*1σ*	*Ca/K*	*%40Ar atm*	*f 39Ar*	*40Ar*/39ArK*	*Age*	*2 σ*
2,00 W	5886,02	3452,78	281,78	165,84	19,940	11,710	644,24	99,50	0,03	37,045	337,97	± 3459,40
2,80 W	526,06	25,45	13,28	0,68	1,810	0,096	24,55	99,66	3,19	1,787	17,83	± 243,56
3,30 W	258,22	16,39	61,53	4,17	0,887	0,064	117,81	98,16	2,06	4,973	49,21	± 200,04
4,00 W	87,11	1,78	14,67	0,50	0,290	0,014	27,14	96,16	3,46	3,379	33,58	± 73,07
5,00 W	25,46	0,32	1,69	0,04	0,068	0,002	3,10	78,12	35,96	5,576	55,09	± 11,65
6,00 W	19,57	0,28	3,67	0,09	0,048	0,002	6,73	71,61	25,23	5,571	55,04	± 11,08
7,00 W	21,67	0,35	4,44	0,13	0,044	0,002	8,16	58,63	30,06	8,994	88,05	± 8,74

J = 0.0055474 ± 0.0000277 Volume 39Ar 0,018 Integrated Dat 63,11837 ± 10,70 Ma

Plateau Age = 55 ± 8 Ma (2s, including J-error of .3 MSWD = 0.093, probability=0.993 69.9% of the 39Ar, steps 1 through 6

Inverse isochron (correlation age) results, plateau steps: Model 1 Solution (±95%-conf.) on 6 poin Age = 55.5 ± 9.6 Ma

40/36 intercept: 294.1 ± 9.2 MSWD = 0.09, Probability = 0 (at J=.005547±.3% 2s)