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**Les interfaces à traces de pas de théropodes du Plateau
des Causses (Sud de la France) : déterminations
palichnologiques et interprétations
paléoenvironnementales**

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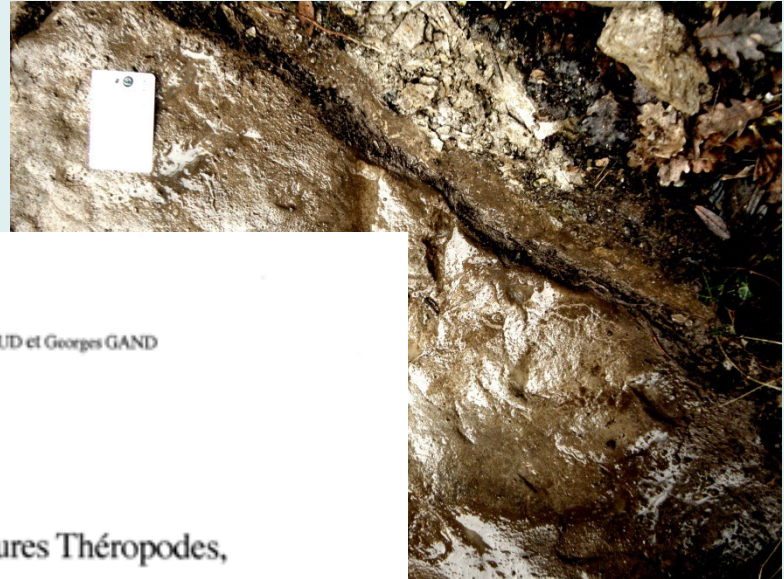
Interfaces with footprints from the Bathonian of the Causses: ichnological determination and paleoenvironmental interpretations

Gwénaél Caravaca, Emmanuel Fara ,
Georges Gand and Christophe Durllet

4th Symposium Cuvier, October 2012

University of Burgundy - Dijon

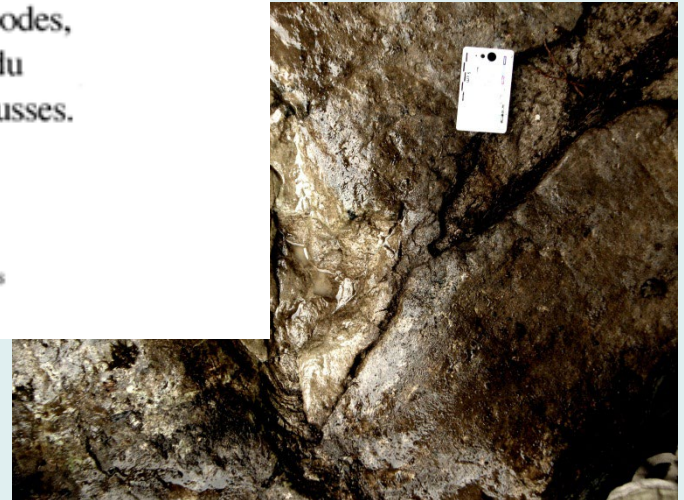
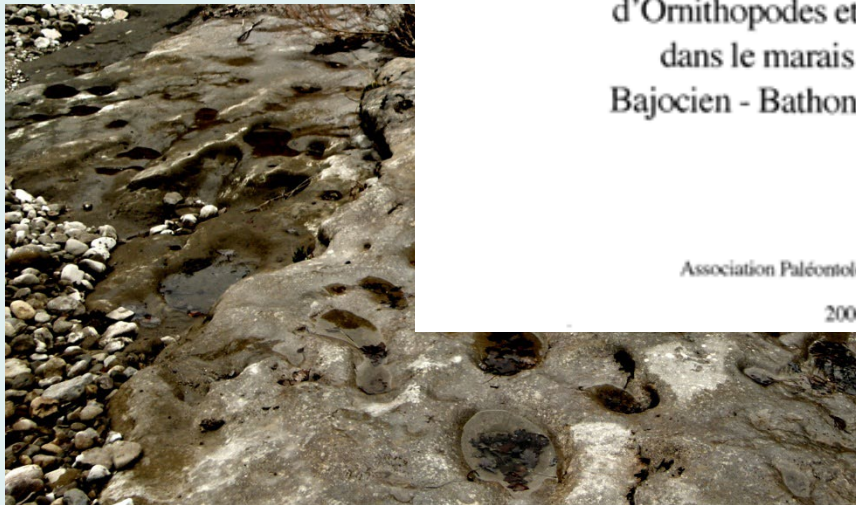
Introduction



Jacques SCLAU, Marc BÉCAUD et Georges GAND

Présence de Dinosaures Théropodes,
et probablement,
d'Ornithopodes et de Sauropodes,
dans le marais maritime du
Bajocien - Bathonien des Causses.

Association Paléontologique des Causses
2006



Objectives

- What is the exact nature of these ichnites?
- What could have left the traces?
- What was the environmental setting?



Study area

4 sites in the “Grands Causses” area,
southern France

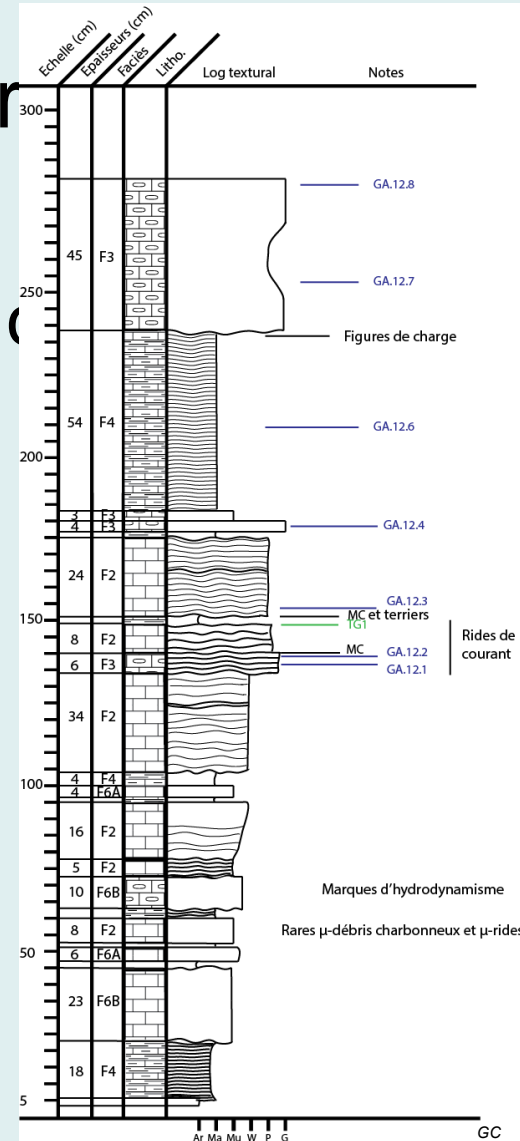


Study area

The “Calcaire à Stipites” Formation

- Lower to middle Bathonian, (164.7 ± 4.0 Ma)
- Brackish, coastal marshland, (167.7 ± 3.5 Ma)
- setting, with lignitic marls

Eonothem	Eon	Era	System	Series	Stage	Age
			Period	Epoch	Age	Ma
Mesozoic		Jurassic	Upper	Tithonian	145.5 ± 4.0	
				Kimmeridgian	150.8 ± 4.0	
				Oxfordian	~ 155.6	
				Callovian	161.2 ± 4.0	
				Bathonian	164.7 ± 4.0	
				Bajocian	167.7 ± 3.5	
			Lower	Aalenian	171.6 ± 3.0	
				Toarcian	175.6 ± 2.0	
				Pliensbachian	183.0 ± 1.5	
				Sinemurian	189.6 ± 1.5	
				Hettangian	196.5 ± 1.0	
					199.5 ± 0.5	
					201.5 ± 0.5	
					203.5 ± 0.5	

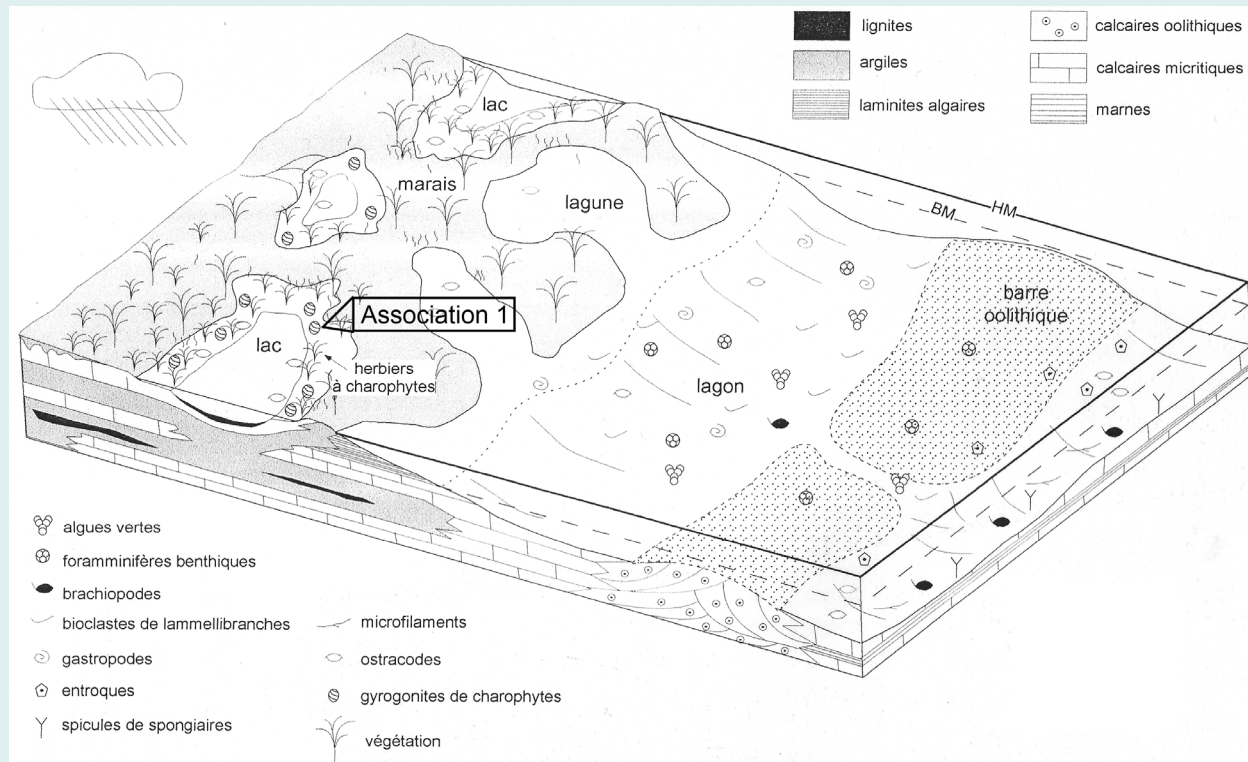


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Environment

- Confirmation of the paleoenvironment described in literature using:
 - Facies
 - Ostracod associations
 - vegetation traces, root-casts



Modified from Charcosset (1998) and Andreu et al. (1999)

=> Changing environment, ranging from lagoons to emerged areas



Methodology

- 4 field campaigns
- Sedimentological approach
- Ichnological approach:
Field measurements, drawings
and statistical analyses
(bivariate diagrams and T-tests)

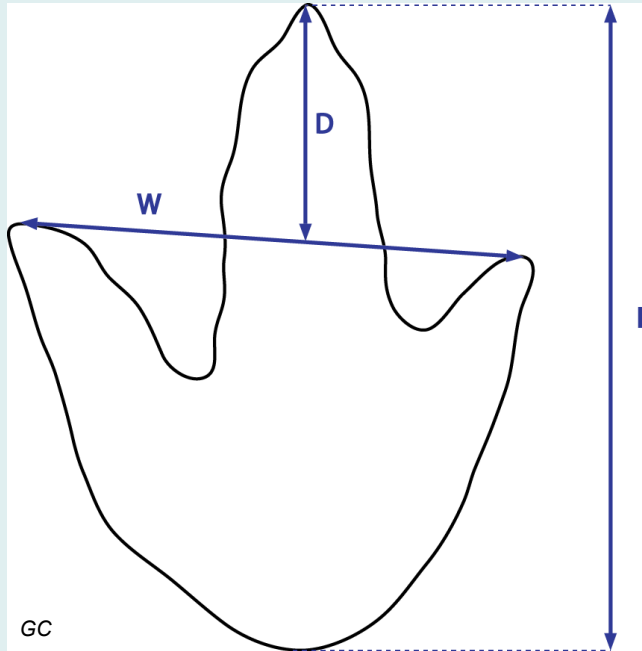


- Tridactyl ichnites: measurements

L, W and D in cm

Ratio $(L-D)/D$

=> Comparison with the Liassic footprints database (from Demathieu et al., 2002)



Results and interpretation

- 2 kinds of traces :
 - Tridactyl ones
 - Ovoid ones

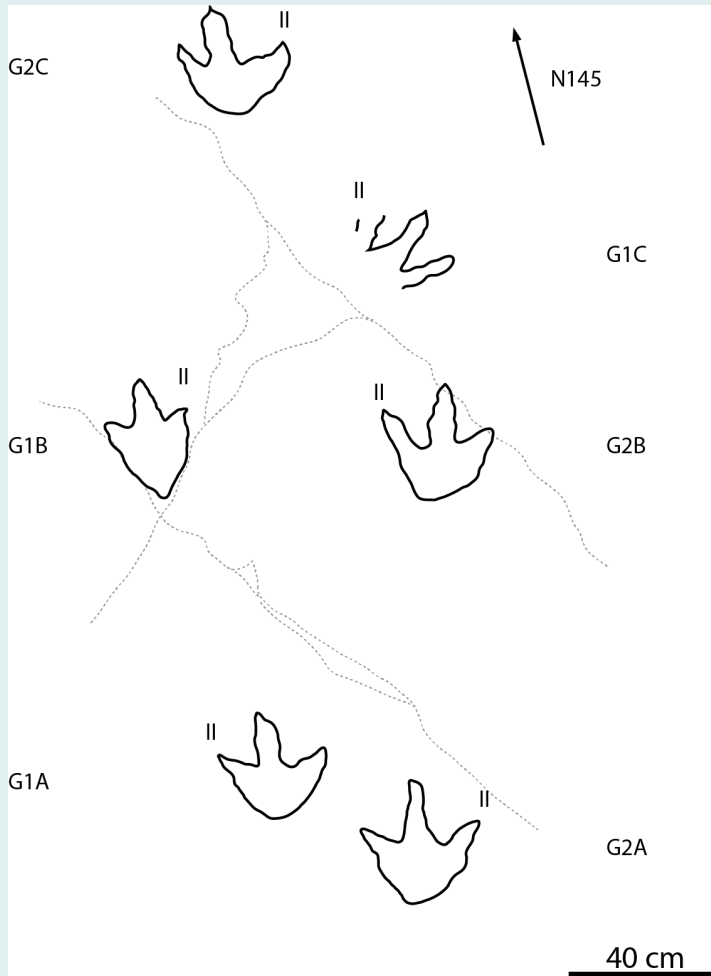


Results and interpretation

- Ovoid marks: 2 possible origins
 - Abiotic: pressure figures, fluvial erosion
 - Biotic: bioturbation due to vegetation



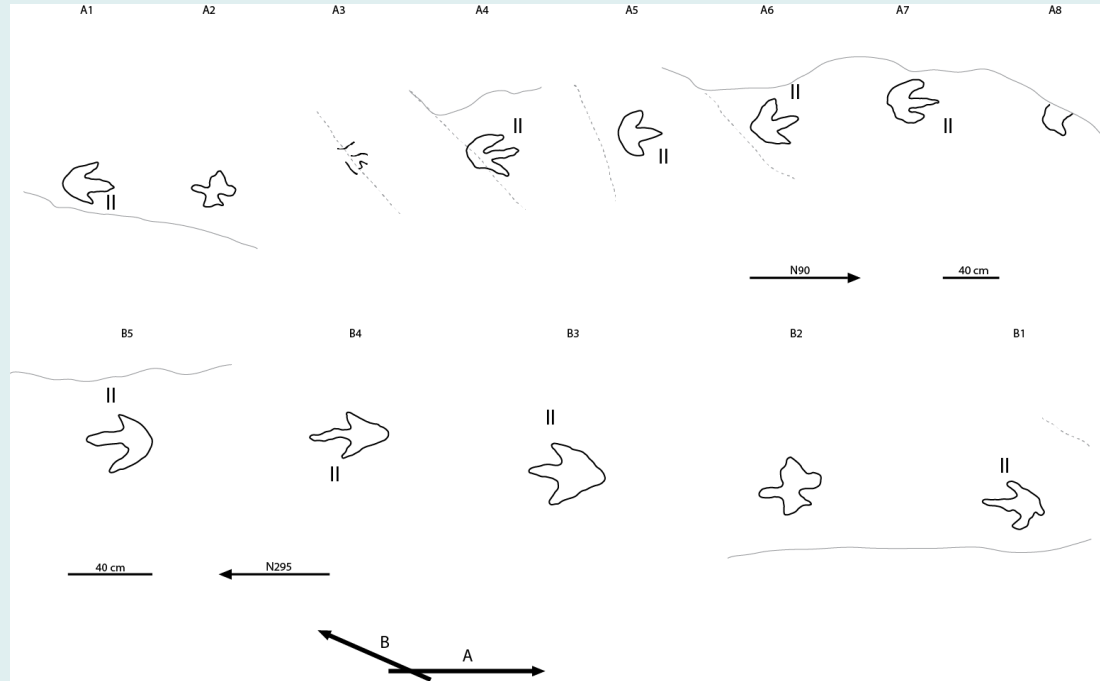
Results and interpretation



Footprints from La Garène



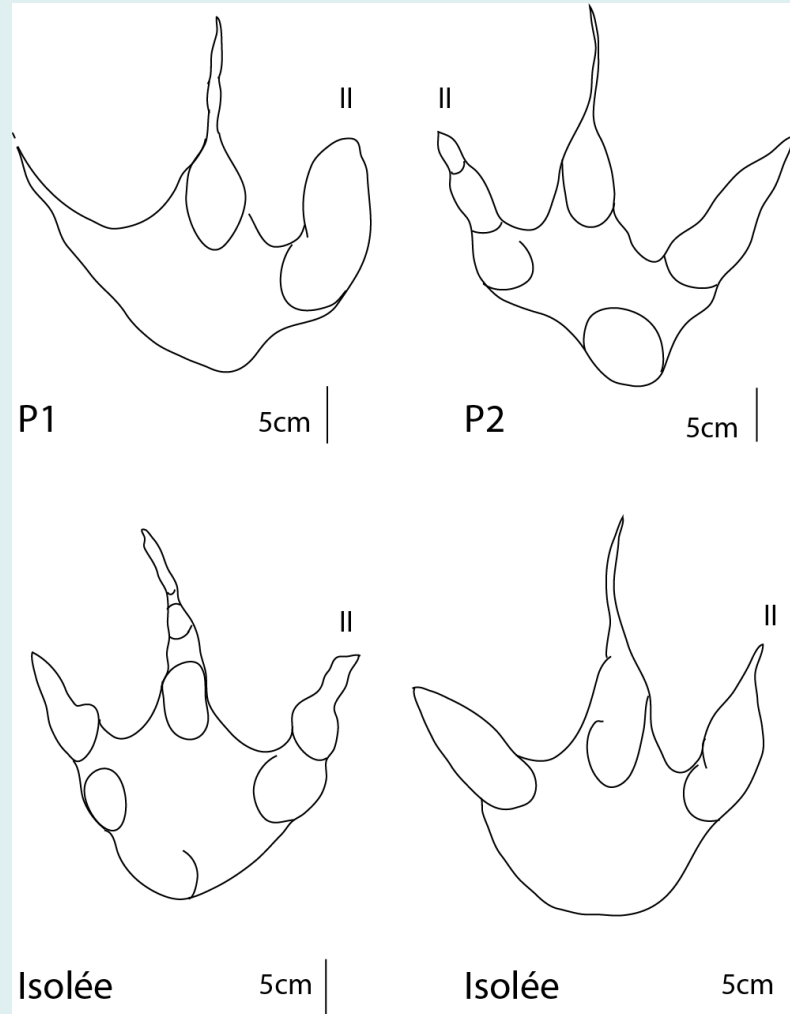
Results and interpretation



Footprints from Le Capelan



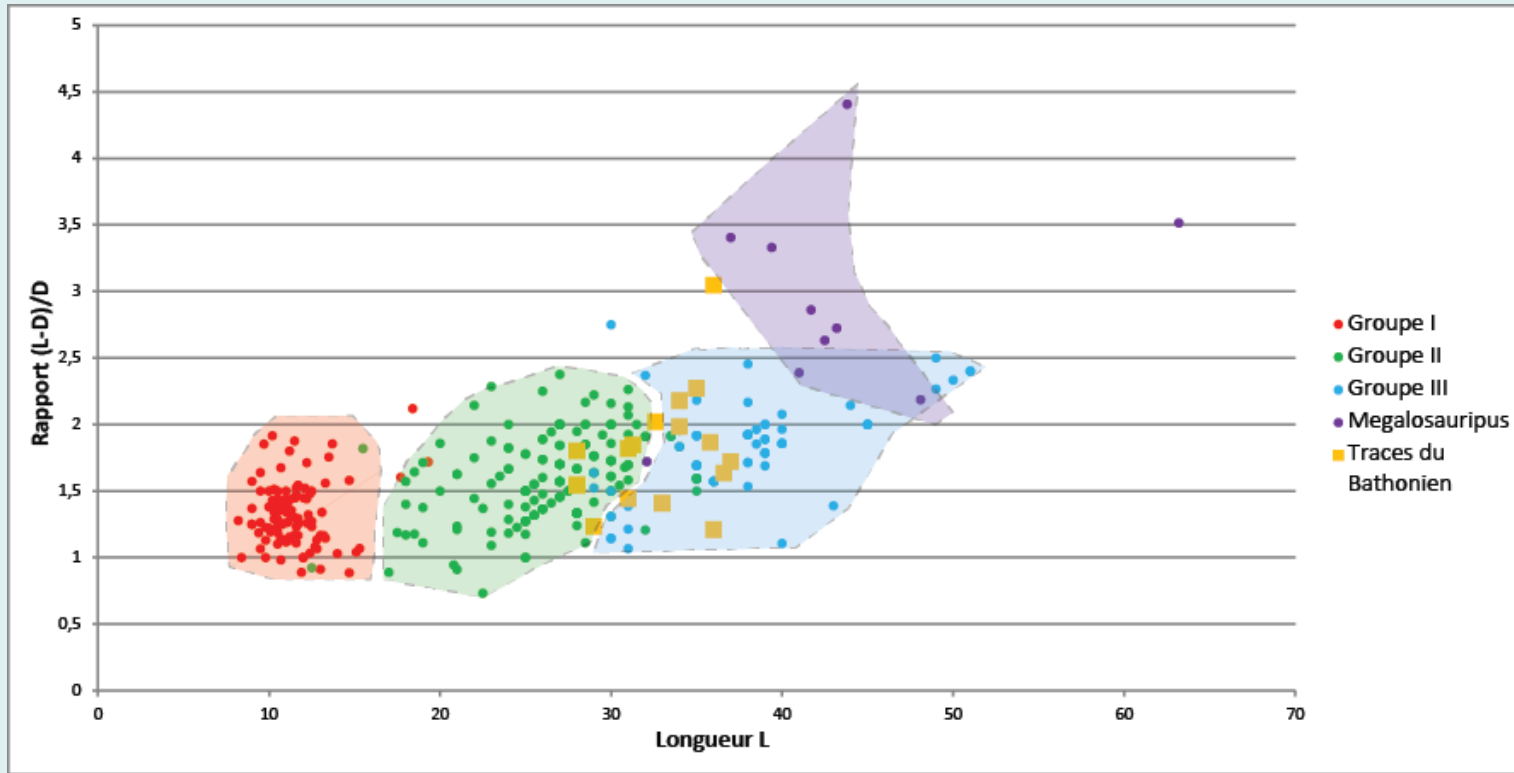
Results and interpretation



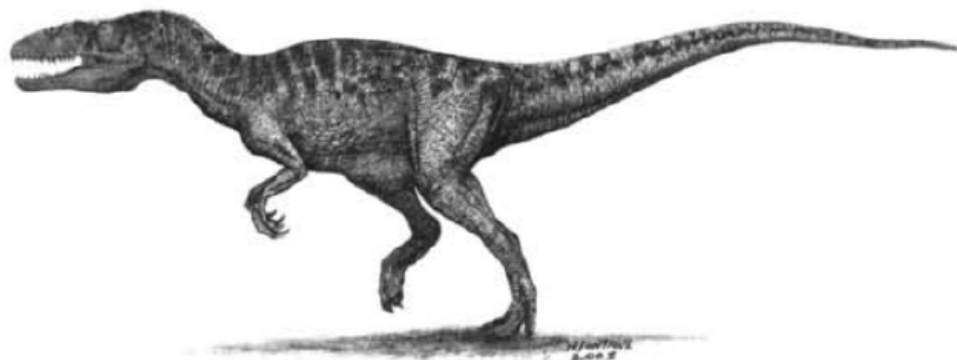
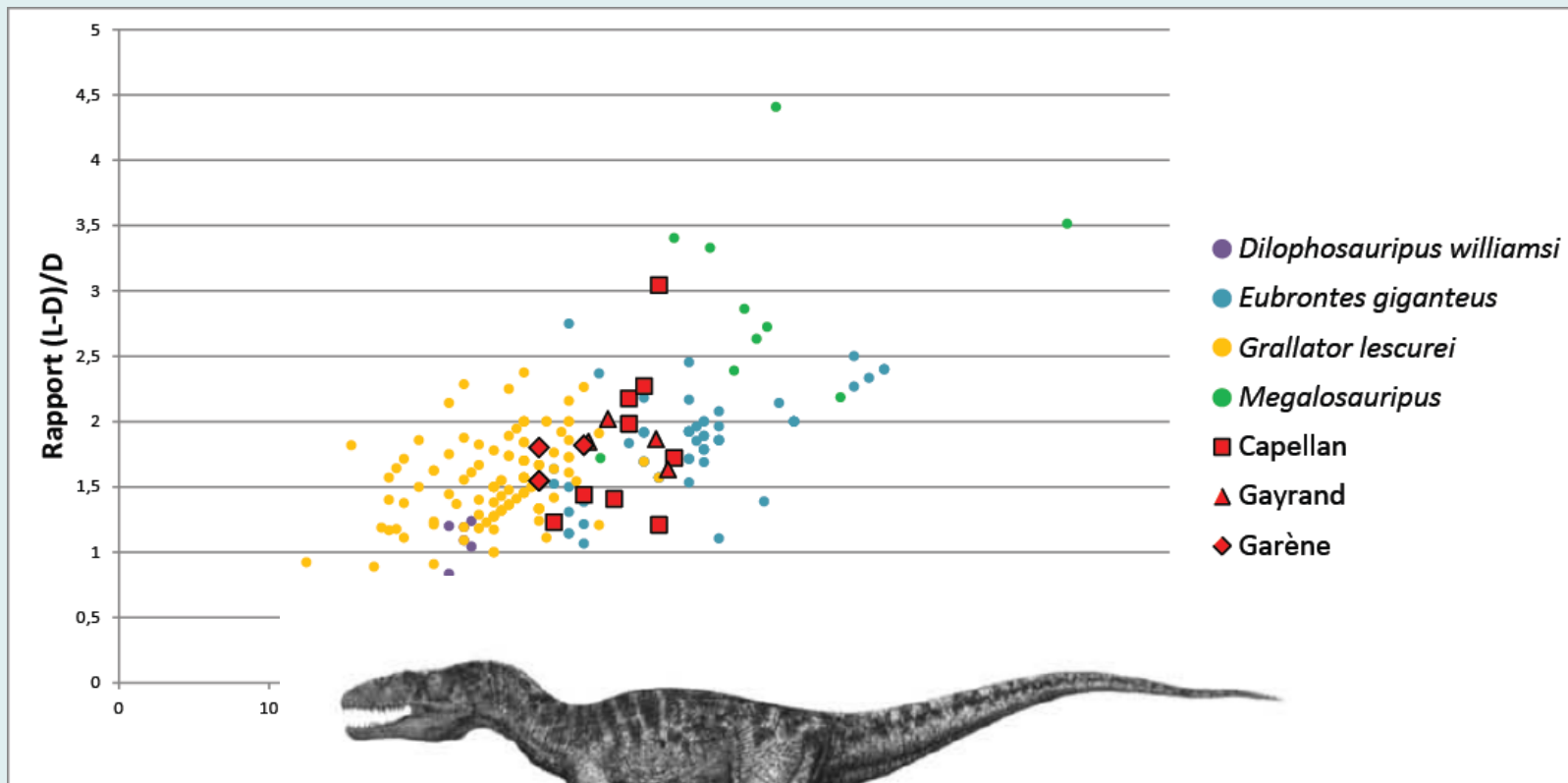
Footprints from Le Gayrand



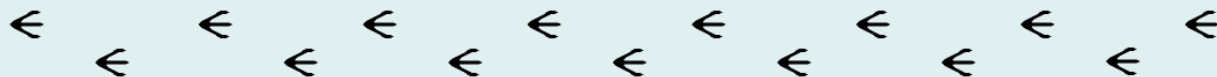
Results and interpretation



Results and interpretation

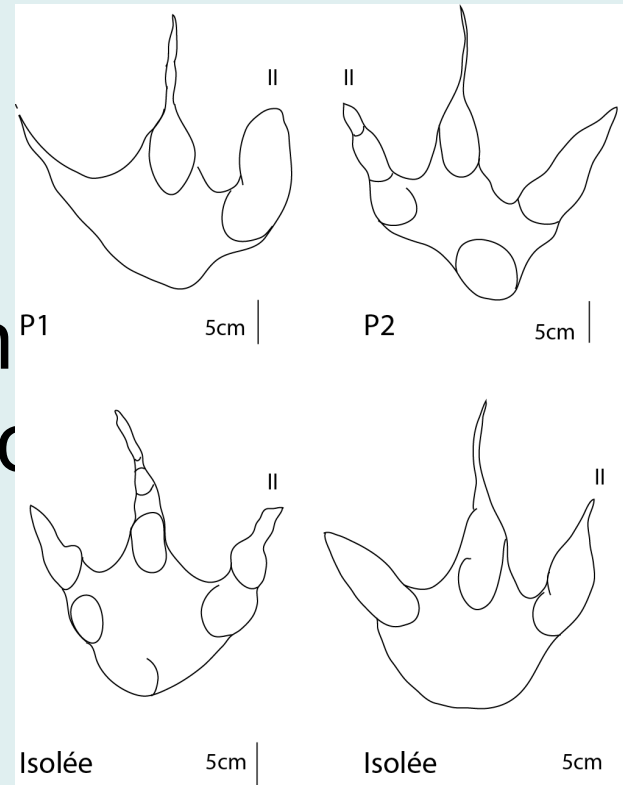


M.Fontaine, in Allain et al., 2003



Results and interpretation

- Tridactyl ichnites made on a substratum covered by water



Perspectives

- New tridac
- Body fossil



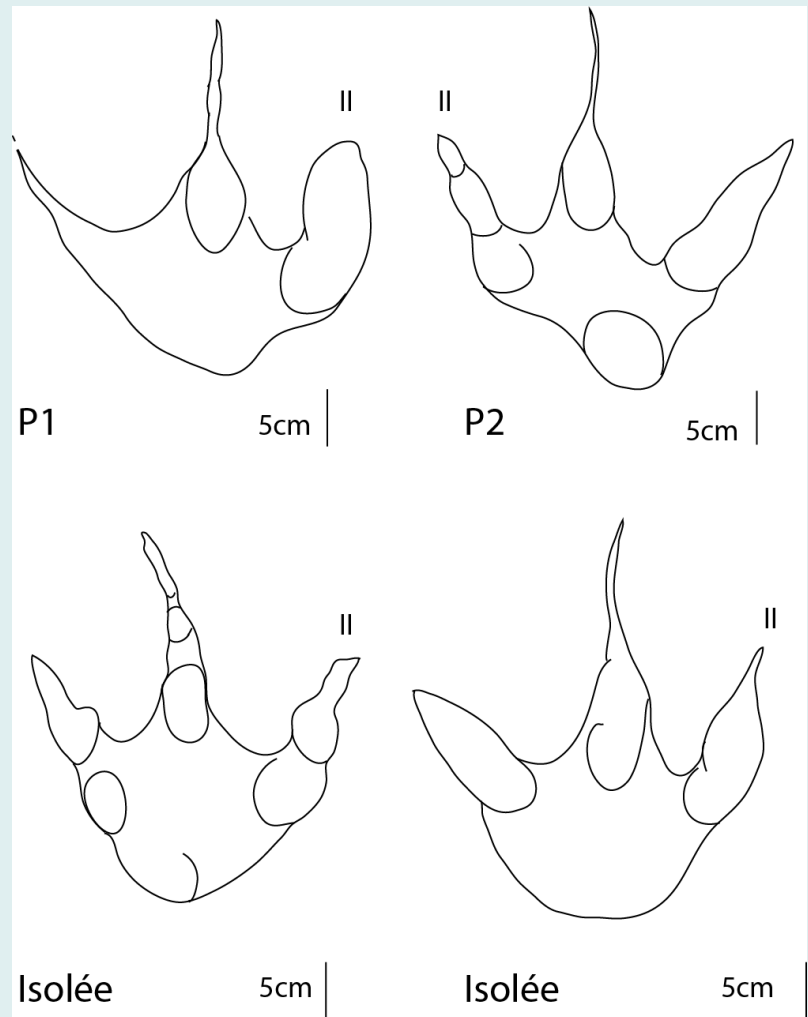
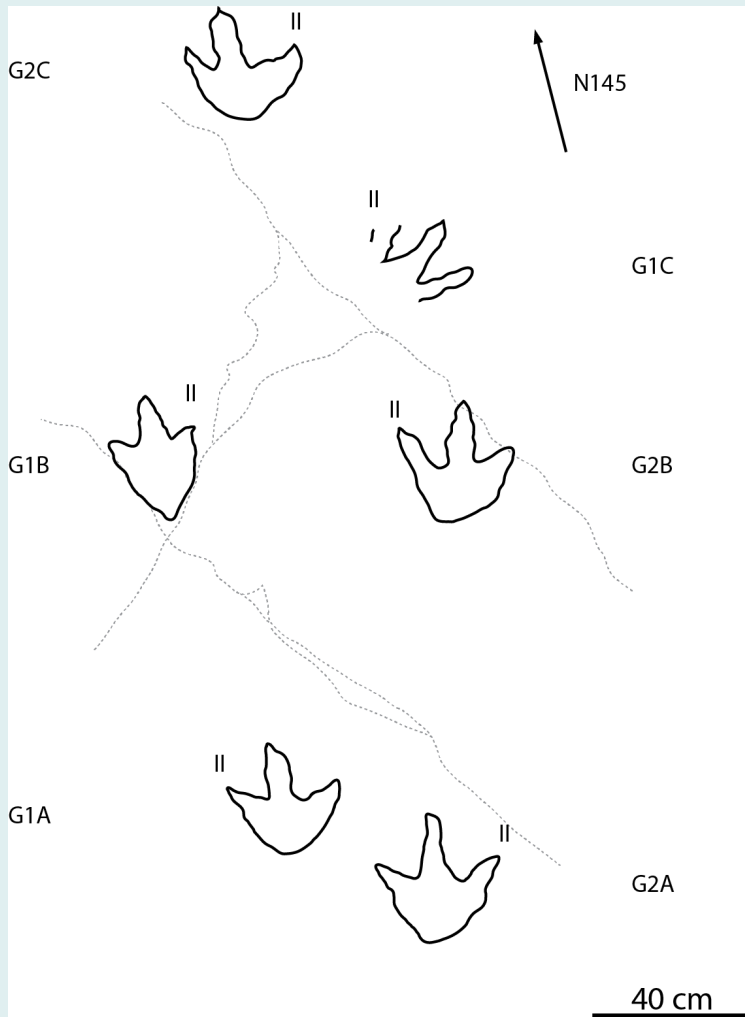
Thank you for your attention

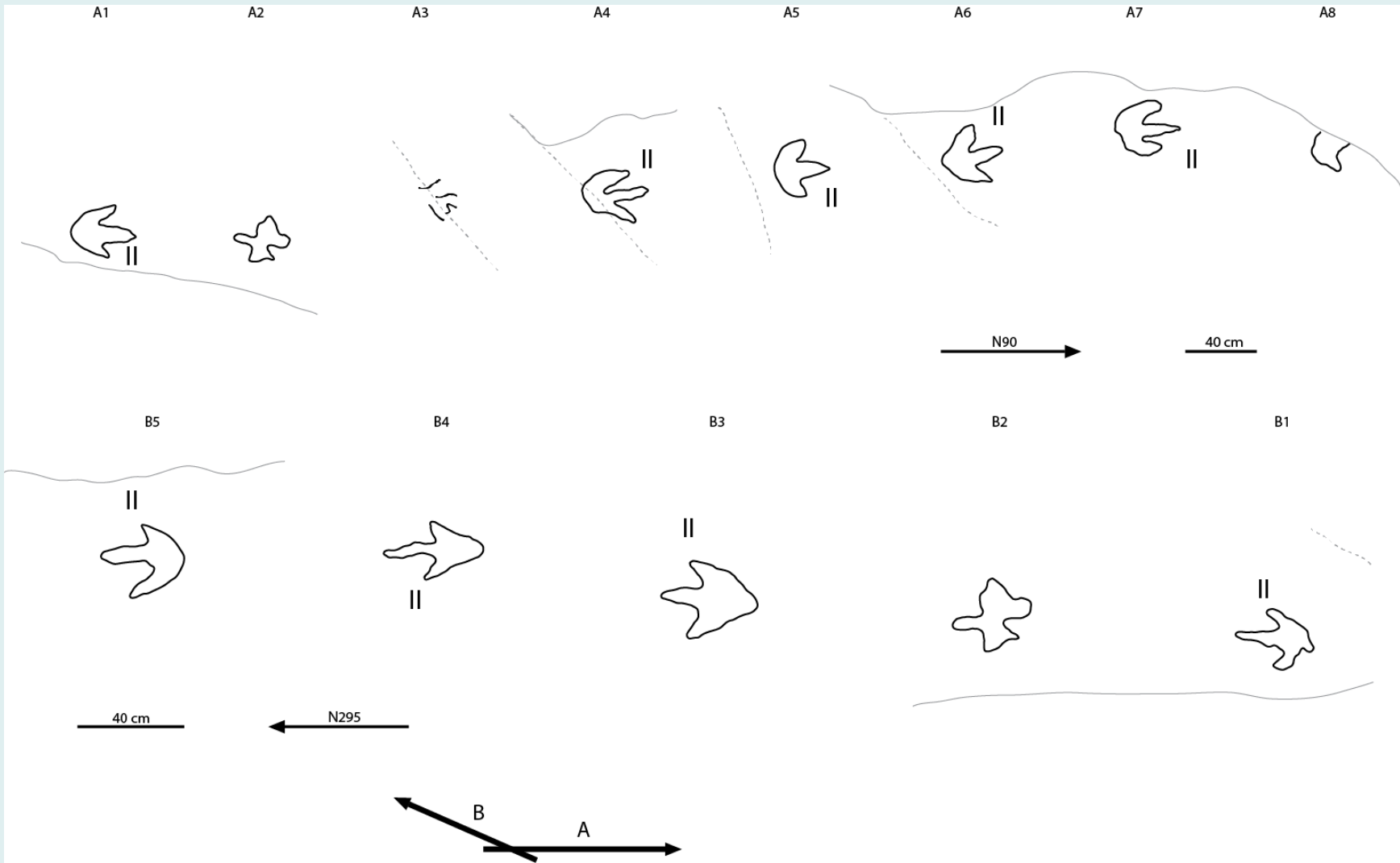


Acknowledgements:

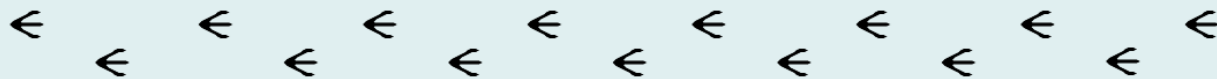
Yves Maurin, Richard Scherrer, Michel Wiene, Parc National des Cévennes; Jean-Paul Gély, Camping du Capelan
Jean-David Moreau, Louis Baret, Daniel André; Harmonie Staebler, Jean-Christophe Laborde







Empreinte	L (cm)	W (cm)	D (cm)		L/W	L/D	(L-D)/D
G1A	28	31	11		0,90322581	2,54545455	1,54545455
G1B	27	37	10		0,72972973	2,7	1,7
G1C			10		*	*	*
G2A	31	32	11		0,96875	2,81818182	1,81818182
G2B	28	31	10		0,90322581	2,8	1,8
G2C	28	31	11		0,90322581	2,54545455	1,54545455
A1	37	29	13,6		1,27586207	2,72058824	1,72058824
A2	23	24	9,8		0,95833333	2,34693878	1,34693878
A3	29	27	11,7		1,07407407	2,47863248	1,47863248
A4	36	26	8,9		1,38461538	4,04494382	3,04494382
A5	31	28,5	12,7		1,0877193	2,44094488	1,44094488
A6	34	30	11,4		1,13333333	2,98245614	1,98245614
A7	34	24,5	10,7		1,3877551	3,17757009	2,17757009
A8	23	20	11,6		1,15	1,98275862	0,98275862
B1	29	20	13		1,45	2,23076923	1,23076923
B2	25	18,9	11,4		1,32275132	2,19298246	1,19298246
B3	35	29	10,7		1,20689655	3,27102804	2,27102804
B4	36	23	16,3		1,56521739	2,20858896	1,20858896
B5	33	29	13,7		1,13793103	2,40875912	1,40875912
P1	31,3	29,7	11		1,05387205	2,84545455	1,84545455
P2	35,8	32,6	12,5		1,09815951	2,864	1,864
I1 (g)	32,6	28,1	10,8		1,16014235	3,01851852	2,01851852
I2 (d)	36,6	31,9	13,9		1,14733542	2,63309353	1,63309353



E	22	32,3	43,1	54,3	66	78	90,3	115,8	142,3	165,7	197,8	226,6	256	285,8	316,2	347
40	27															
50	35	22,8														
60	43	28,1	20,4													
70		32,8	24,0	18,8												
80		30,3	27,7	21,6	17,7											
90			31,5	24,5	19,9	16,8										
100			35,5	27,4	22,3	18,7	16,1									
120				33,5	27,0	22,6	19,4	15,0								
140				40,1	32,0	26,7	22,8	17,6	14,2							
160					37,3	30,9	26,3	20,2	16,3	13,6						
180						35,2	29,9	22,9	18,4	15,4	13,2					
200							33,6	25,6	20,6	17,1	14,5	12,7				
220								37,5	28,4	22,7	18,9	16,1	14,1	12,4		
240									31,2	24,9	20,7	17,7	15,4	13,6	12,1	
260										34,2	27,2	22,5	19,2	16,7	14,7	13,2
280											29,5	24,4	20,7	18,0	15,9	14,2
300												31,8	26,2	22,3	19,3	17,0
320													28,1	23,9	20,7	18,2
340														25,5	22,0	19,4
360															27,1	23,4
380																24,8

From Demathieu, 1986





Fig.1 : LC-12-1



Fig.2 : LC-12-2



Fig.3 : LC-12-3



Fig.4 : LC-12-4



Fig.5 : LC-12-5



Fig.1 : GA-12-1



Fig.2 : GA-12-2



Fig.3 : GA-12-3



Fig.4 : GA-12-4



Fig.5 : GA-12-7



Fig.6 : GA-12-8



Fig.7 : GA-12-D



Fig.8 : GA3-12-16

