Pleural Mesothelioma in New Caledonia: Associations with Environmental Risk Factors - SUPPLEMENTAL MATERIAL

Authors:

Francine Baumann[1], Pierre Maurizot[2], Morgan Mangeas[3], Jean-Paul Ambrosi[4], Jeroen Douwes[5], Bernard Robineau[6]

Institution: Université de la Nouvelle-Calédonie, ERIM, B.P. R4, 98851 Nouméa Cedex, New Caledonia

Affiliations:

1. Université de la Nouvelle-Calédonie, ERIM [EA3791], Noumea, New Caledonia
2. Bureau de la Recherche Géologique et Minière, Noumea, New Caledonia
3. Institut de Recherche pour le Développement, US140 ESPACE, Noumea, New Caledonia
4. CEREGE, Aix Marseille University, CNRS, Collège de France, Aix-en-Provence, France
5. Centre for Public Health Research, Massey University, Wellington, New Zealand
6. Service Géologique, DIMENC, Noumea, New Caledonia

Corresponding author: Francine Baumann, Institut de Recherche pour le Développement, US140 ESPACE, BP A5, 98848 Noumea cedex, New Caledonia. Tel: (687) 26 08 32. Fax: (687) 26 43 26. E-mail: fbaumann@live.fr

TABLE OF CONTENTS

page

Table 1 – Distribution of all MM cases, NC 1984-2008, by ethnicity, gender and age group..... 3

Table 2 – Number of cases by commune, crude incidence and ASR of MM with 95% confidence interval (CI), by two methods: longer place of residence and residence 30 years before diagnosis (after exclusion of 20 years from the date of the diagnosis)…….. 4

Table 3 – Tribes, number of MM cases 1984-2008, sex distribution, crude and world age standardized incidences, 95% confidence intervals, by two methods : residence 30 years before diagnosis and longer time of residence…….. 5

Figure 1 – MM age standardized incidence by council per 100,000 inhabitants-years, by two methods: residence 30 years before diagnosis and longer time of residence..... 7

Figure 2 – Distributions of explicative variables values by tribes with and without MM cases..... 8

Figure 3 – Photographies of natural outcrops of tremolite, vein of chrysotile, antigorite in a serpentinite quarry and on a road, New Caledonia…….. 9

Figure 4 – Maps of Houaïlou-Bourail-Poya and Kone-Poindimié-Touho-Hienghène areas, serpentinite outcrops, quarries of serpentinite and ASR of MM by tribe, 1984-2008..... 10

Figure 5 - Maps of Houaïlou-Bourail-Poya and Kone-Poindimié-Touho-Hienghène areas, use of tremolitic Pö and standardized incidence of MM by tribe, 1984-2008..... 11

Figure 6 – Maps of Houaïlou-Bourail-Poya and Kone-Poindimié-Touho-Hienghène areas, number of dwellings covered with tremolitic Pö and standardized incidence of MM by tribe, 1984-2008..... 12

Figure 7 – Study area, geological map of asbestos bearing units, tonnage of garnierite extracted 1940-1980, main roads and MM ASR by tribe (residence 30 years before diagnosis), 1984-2008..... 13

Supplemental Material, Table 1 – Distribution of all MM cases, NC 1984-2008, by ethnicity, gender and age group

Age group	**Melanesians**		**Caucasians**		**Polynesians**		**All**		
(years)	**men**	**women**	**men**	**women**	**men**	**women**	**men**	**women**	**Total**
30-39	1	4	0	0	1	0	2	4	6
40-49	6	6	0	2	1	0	7	8	15
50-59	13	16	1	0	0	1	14	17	31
60-69	10	11	1	0	2	0	13	11	24
70-79	9	13	2	0	0	0	11	13	24
80-89	1	1	1	1	0	0	2	2	4
Total	**40**	**51**	**5**	**3**	**4**	**1**	**49**	**55**	**104**
mean age	**60.3**	**59.5**	**71.9**	**57.0**	**52.6**	**51.0**	**60.8**	**59.2**	**60.0**
sex ratio	**0.784**		**1.667**		**4.000**		**0.891**		

Supplemental Material, Table 2 – Number of cases by commune, crude incidence and ASR of MM with 95% confidence interval (CI), by two methods: longer place of residence and residence 30 years before diagnosis (after exclusion of 20 years from the date of the diagnosis)

	Longer place of residence					Residence 30years before diagnosis				
Commune	**nb**	**Crude Inc.**	***95%CI***	**ASR**	***95%CI***	**nb**	**Crude Inc.**	***95%CI***	**ASR**	***95%CI***
Houailou	34	32,7	*22.65 - 45.7*	112,28	*77.73 - 156.9*	37	35,59	*25.06 - 49.05*	128,66	*70.41 - 137.84*
Kone	14	14,27	*7.8 - 23.94*	23,81	*13.02 - 39.96*	15	15,29	*8.56 - 25.22*	25,46	*14.25 - 41.98*
Poindimié	11	10,56	*5.27 - 18.9*	13,98	*6.98 - 25.01*	12	11,52	*5.95 - 20.12*	15,37	*3.17 - 44.92*
Touho	4	7,46	*1.87 - 19.1*	11,4	*3.11 - 29.19*	3	5,6	*1.15 - 16.35*	9	*1.86 - 26.29*
Ouégoa	3	6,15	*1.27 - 17.96*	10,2	*2.1 - 29.82*	3	6,15	*1.27 - 17.96*	8,5	*1.75 - 24.85*
Poya	3	4,96	*1.02 - 14.48*	7,84	*1.62 - 22.92*	3	4,96	*1.02 - 14.48*	7,84	*1.62 - 22.92*
Bourail	9	8,59	*3.93 - 16.31*	9,77	*4.47 - 18.55*	7	6,68	*2.69 - 13.78*	7,55	*3.04 -15.56*
Canala-Kouaoua	4	4,94	*1.35 - 12.65*	6,88	*1.88 - 17.62*	4	4,94	*1.35 - 12.65*	6,88	*0.17 - 38.34*
Thio	2	3,19	*0.39 - 11.52*	6,52	*0.79 - 23.56*	2	3,19	*0.39 - 11.52*	6,52	*1.35 - 19.06*
Hienghène	1	1,89	*0.05 - 10.51*	4,68	*0.12 - 26.06*	1	1,89	*0.05 - 10.51*	4,68	*0.12 - 26.06*
Ile des Pins	1	2,23	*0.06 - 12.41*	3,11	*0.08 - 17.34*	0	-	-	-	-
Koumac	1	2,23	*0.06 - 12.41*	3,11	*0.08 - 17.34*	1	1,57	*0.04 - 8.77*	2	*0.05 - 11.13*
Lifou	5	2,08	*0.68 - 4.86*	3,23	*1.05 - 7.53*	3	1,25	*0.26 - 3.65*	2	*0.41 - 5.83*
Ponerihouen	1	1,55	*0.04 - 8.63*	1,89	*0.05 - 10.51*	1	1,55	*0.04 - 8.63*	1,89	*0.05 - 10.51*
Mont Dore	3	0,6	*0.12 - 1.76*	0,72	*0.15 - 2.09*	2	0,4	*0.05 - 1.45*	0,72	*0.15 - 2.09*
Nouméa	8	0,52	*0.23 - 1.03*	0,58	*0.25 - 1.22*	9	0,49	*0.22 - 0.93*	0,64	*0.13 - 1.88*
Dumbéa	0	- -	-	0	-	1	0,42	*0.01 - 2.32*	0,4	*0.01 - 2.26*
Total	**104**					**104**				

Abbreviations: nb, number of MM cases; Inc, incidence

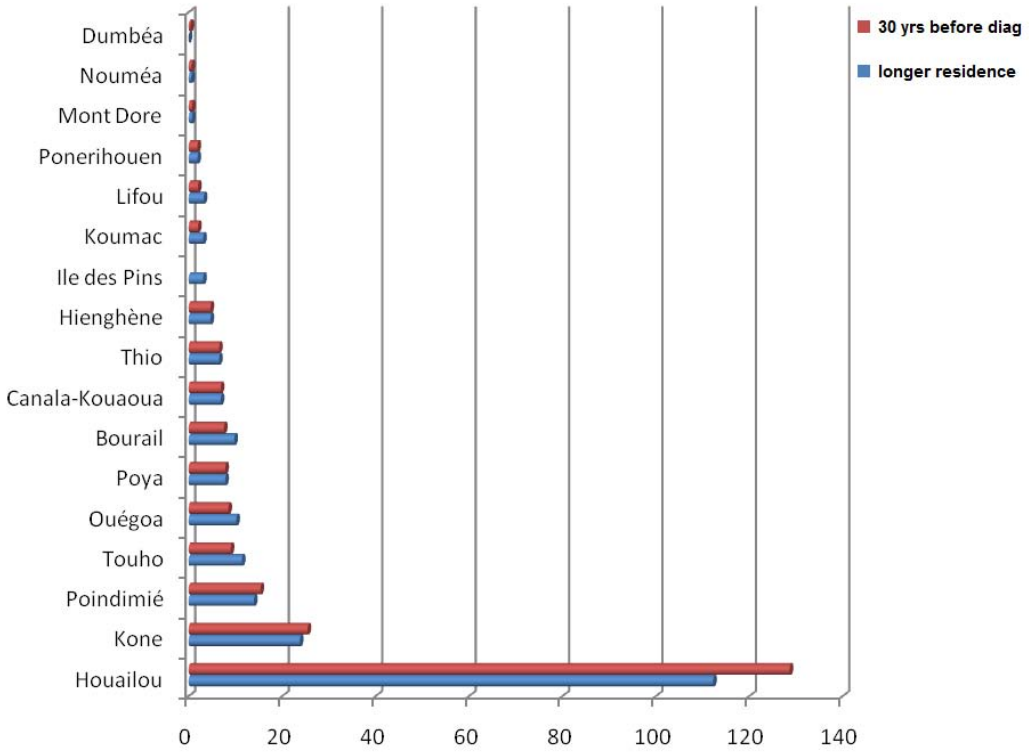
Supplemental Material, Table 3 – Tribes, number of MM cases 1984-2008, sex distribution, crude and world age standardized incidences, 95% confidence intervals, by two methods : residence 30 years before diagnosis and longer time of residence.

COUNCIL	TRIBE	N-30	nb men	nb wom.	Cr Inc-30	CI95%		ASR-30	CI95%		Nb+lg	Cr Inc +lg	CI95%		ASR+lg	CI95%	
Bourail	Azareu	1	1	0	30.9	1.63	152.05	23.6	0.6	131.25	2	64.1	11.4	201.79	47.1	5.71	170.19
Bourail	Bouirou	5	3	2	99.6	99.6	39.24	229.6	74.6	535.91	6	119.5	52.1	235.9	249.7	91.4	543.55
Bourail	Gouaro	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Bourail	Ny	1	1	0	27.8	27.8	1.42	31.4	0.79	175.01	1	27.8	1.42	131.78	31.4	0.79	175.01
Bourail	Oua-Oué	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Bourail	Pothé	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Bas Coulna - Ouayatte	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Caavatch	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Ganem	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Haut Coulna	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Le Koulnoue	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Lewarap	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Linderalique	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Ouaieme	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Ouare Ouen-Pouest Tilougne	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Ouayaguette	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Ouenghip	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Panie	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Pindache	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Poindjap	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Pouyemben	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Tendo	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Hienghene	Tiendanite	1	0	2	61.7	3.15	292.84	68.1	1.72	379.18	1	61.7	3.15	292.84	68.1	1.72	379.18
Hienghene	Tiwamack	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Ba	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Boéareu	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Boréaré	1	0	1	179	9.11	847.14	204.2	5.17	1 137.54	0	-	-	-	-	-	-
Houaïlou	Coula/Koro	1	0	1	45.5	2.32	215.64	55	1.39	306.44	1	45.5	2.32	215.64	55	1.39	306.44
Houaïlou	Gondé	1	0	1	46.7	2.38	221.68	68.1	1.72	379.18	0	-	-	-	-	-	-
Houaïlou	Gouaraoui	1	1	0	100	5.1	474.4	102.1	2.58	568.77	2	200	35.5	629.6	204.2	24.7	737.51
Houaïlou	Gouareu	2	1	1	98	17.4	308.63	202	24.5	729.59	2	98	17.4	308.63	202	24.5	729.59
Houaïlou	Kamoui	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Kaora	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Kapoué	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Karagreu	1	0	1	49.5	2.52	234.85	61.3	1.55	341.26	1	49.5	2.52	234.85	61.3	1.55	341.26
Houaïlou	Kua	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Mé	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Méareu	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Médaouya	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Méomo	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Néaoua	7	5	2	547	220	1126.8	601.5	242	1 239.29	5	390.6	154	821.33	418.1	114	1070.57
Houaïlou	Néaria	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Nédiouen	3	1	2	54	14.7	139.46	69.5	14.3	203.24	5	89.9	35.4	189.08	114.1	37.1	266.25
Houaïlou	Nédivin	3	2	1	68.2	18.6	176.23	212.5	43.8	621.01	3	68.2	18.6	176.23	212.5	43.8	621.01
Houaïlou	Nékoué	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Néoua	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Néouyo	2	0	2	65.4	11.6	205.75	48.8	5.91	176.17	2	65.4	11.6	205.75	48.8	5.91	176.17
Houaïlou	Nérin	1	0	1	192	9.81	912.31	306.3	7.75	1 706.30	2	384.6	68.3	1 210.77	612.5	74.2	2 212.53
Houaïlou	Nessa Kouya	2	0	2	63.7	11.3	200.51	86.4	10.5	312.11	3	95.5	26.1	246.94	122.4	25.3	357.79
Houaïlou	Néya	0	-	-	-	-	-	-	-	-	0						
Houaïlou	Nindiah	6	2	4	476	207	939.84	451.6	165	982.88	2	158.7	28.2	499.68	163.3	19.8	590.01
Houaïlou	Oingo	1	0	1	333	17	1 581.33	275	6.96	1 532.19	1	333.3	17	1 581.33	275	6.96	1 532.19
Houaïlou	Ouakaya	1	0	1	96.2	4.9	456.15	111.4	2.82	620.47	1	96.2	4.9	456.15	111.4	2.82	620.47
Houaïlou	Ouessoin	3	1	2	429	117	1 107.71	581.3	120	1 698.65	3	428.6	117	1 107.71	581.3	120	1 698.65
Houaïlou	Paraouyé	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Roibahon	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Houaïlou	Thu	1	1	0	41.7	2.13	197.67	29.9	0.76	166.47	1	41.7	2.13	197.67	29.9	0.76	166.47
Koné	Atéou	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Koné	Baco	1	0	1	16.7	16.7	0.85	19.1	0.48	106.64	1	16.7	0.85	79.33	19.1	0.48	106.64
Koné	Bopope	1	1	0	13.4	34.5	1.76	38.3	0.97	213.29	1	34.5	1.76	163.59	38.3	0.97	213.29
Koné	Koniambo	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Koné	Néami	2	1	1	44.1	7.82	138.68	30.6	0.77	170.63	0	-	-	-	-	-	-
Koné	Netchaot	3	0	3	54.7	54.7	14.93	184.6	38.1	539.52	3	54.7	14.9	141.5	184.6	38.1	539.52
Koné	Noéli	4	2	2	165	56.5	378.26	188.7	51.4	483.25	3	124	33.8	320.41	139.7	28.8	408.38
Koné	Poindah	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Koné	Tiaoué	3	1	2	64.1	17.5	165.68	73.6	8.91	265.81	4	85.5	29.2	195.6	100.8	27.5	258.11
Poindimié	Bayes	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	Galilée	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	Ina	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	Napoémien	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	Nessapoué	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	Ometteux	2	1	1	46.3	46.3	8.22	60.1	7.28	217.07	1	23.1	1.18	109.81	26.1	0.66	145.22
Poindimié	Ouindo	1	1	0	84.7	4.32	402.03	81.7	2.07	455.01	1	84.7	4.32	402.03	81.7	2.07	455.01
Poindimié	Paama	0	-	-	-	-	-	-	-	-	1	133.3	23.7	419.73	81.7	2.07	455.01
Poindimié	Pambou	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-

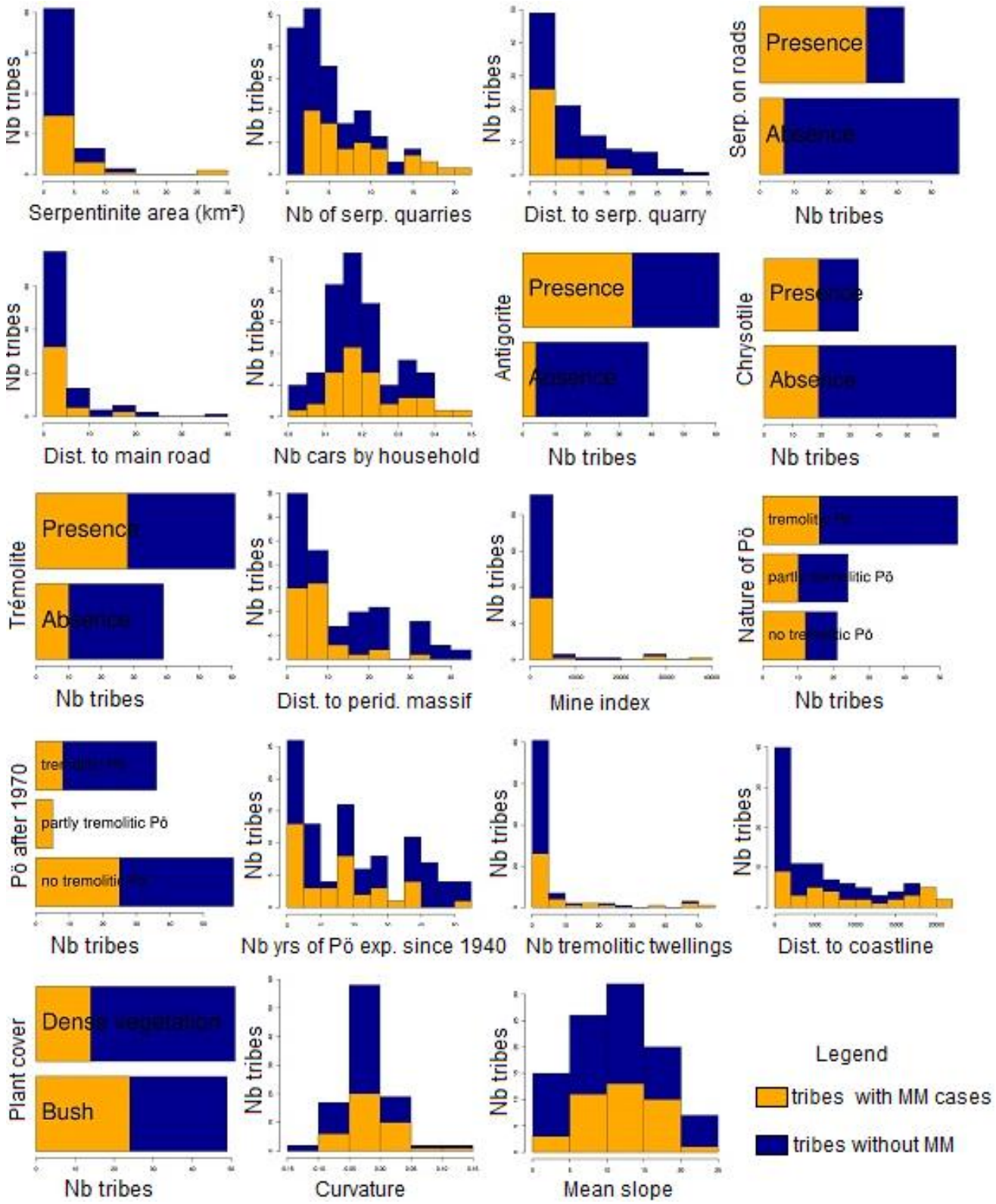
Poindimié	St Denis	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	St Michel	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	St Paul	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	St Thomas	2	1	1	37.9	6.72	119.24	40.6	4.91	146.56	2	37.9	6.72	119.24	40.6	4.91	146.56
Poindimié	Ti - Ouano	2	0	2	106	18.9	334.89	116.7	14.1	421.44	1	53.2	2.71	252.34	58.3	1.48	325.01
Poindimié	Tibarama	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poindimié	Tié	1	0	1	17.5	17.5	0.89	16.3	0.41	91	1	17.5	0.89	82.94	16.3	0.41	91
Poindimié	Tiéti	1	1	0	11.5	11.5	0.59	11.6	0.29	64.39	1	11.5	0.59	54.65	11.6	0.29	64.39
Poindimié	Tiwaka	3	1	2	188	51.1	484.63	200.6	41.4	586.19	3	187.5	51.1	484.63	200.6	41.4	586.19
Poya	Goipin	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poya	Montfaoué	2	1	1	50.8	50.8	9.01	65.9	7.98	238.08	2	50.8	9.01	159.8	65.9	7.98	238.08
Poya	Nekliaï	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poya	Népou	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poya	Nétéa	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Poya	Ouendji	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Koé	1	0	1	21.2	21.2	1.08	23.6	0.6	131.25	1	21.2	1.08	100.51	23.6	0.6	131.25
Touho	Kokingone	1	0	1	38.8	1.98	183.88	45.8	1.16	255.37	2	77.5	13.8	244.03	92.9	11.3	335.76
Touho	Kongouma	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Ouanache	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Paola	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Pombeï	1	1	0	64.9	3.31	308.05	91.7	2.32	510.73	1	64.9	3.31	308.05	91.7	2.32	510.73
Touho	Tiouandé	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Tiwae	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Touho Mission	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
Touho	Vieux-Touho	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-

Abbreviations: N-30, number of MM cases (residence 30 years before diagnosis); wom.,women; Cr Inc, crude incidence; Nb+lg, number of MM cases (longer time of residence)

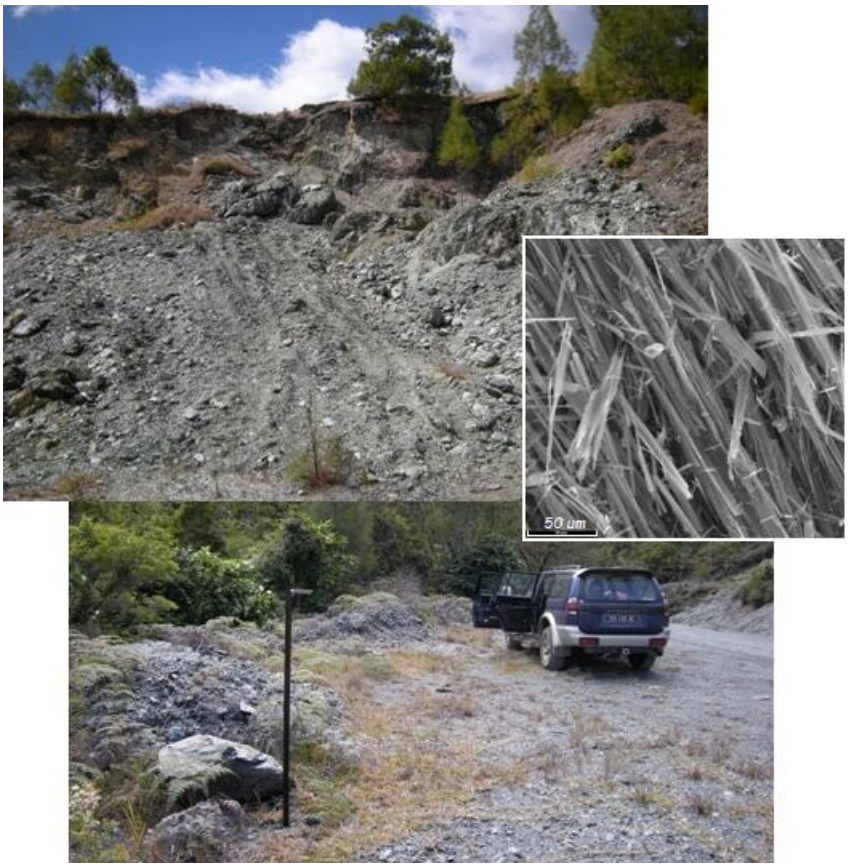
Supplemental Material, Figure 1 – MM age standardized incidence by council per 100,000 inhabitants-years, by two methods: residence 30 years before diagnosis and longer time of residence



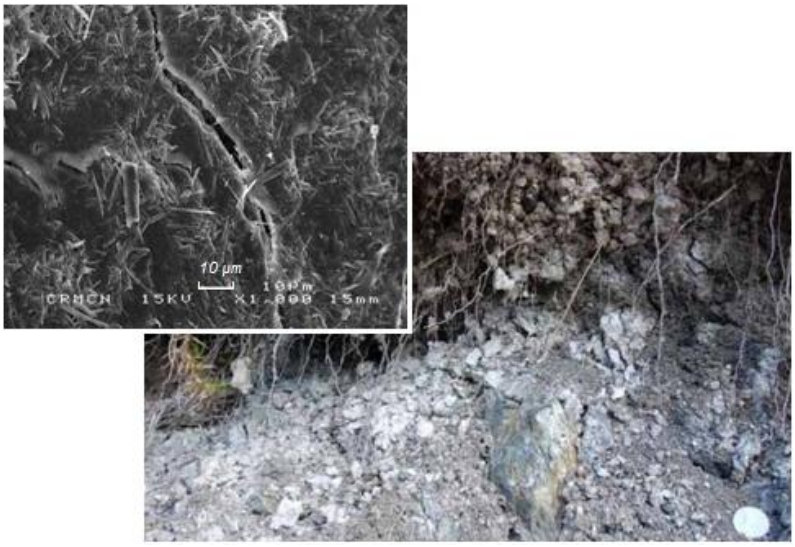
Supplemental Material, Figure 2 – Distributions of explicative variables values by tribes with and without MM cases



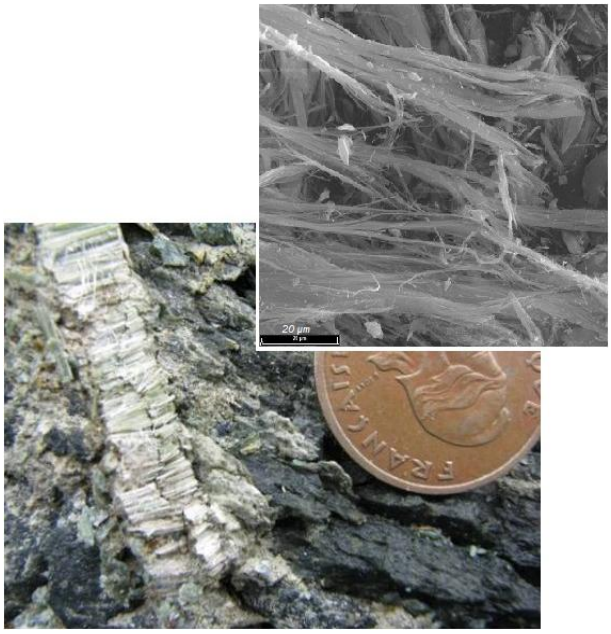
Supplemental Material, Figure 3 – Photographs of natural outcrops of tremolite, vein of chrysotile, antigorite in a serpentinite quarry and on a road, New Caledonia, and electron microphotographs



Antigorite

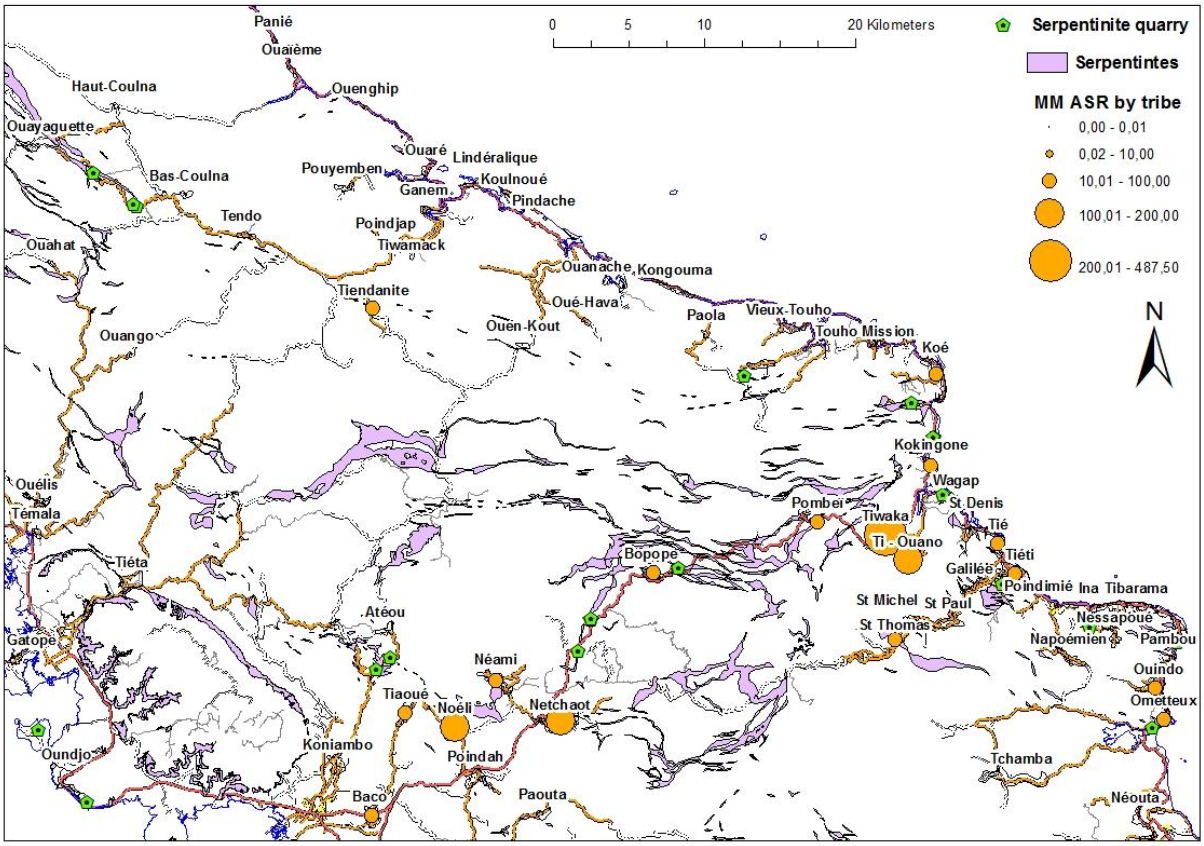


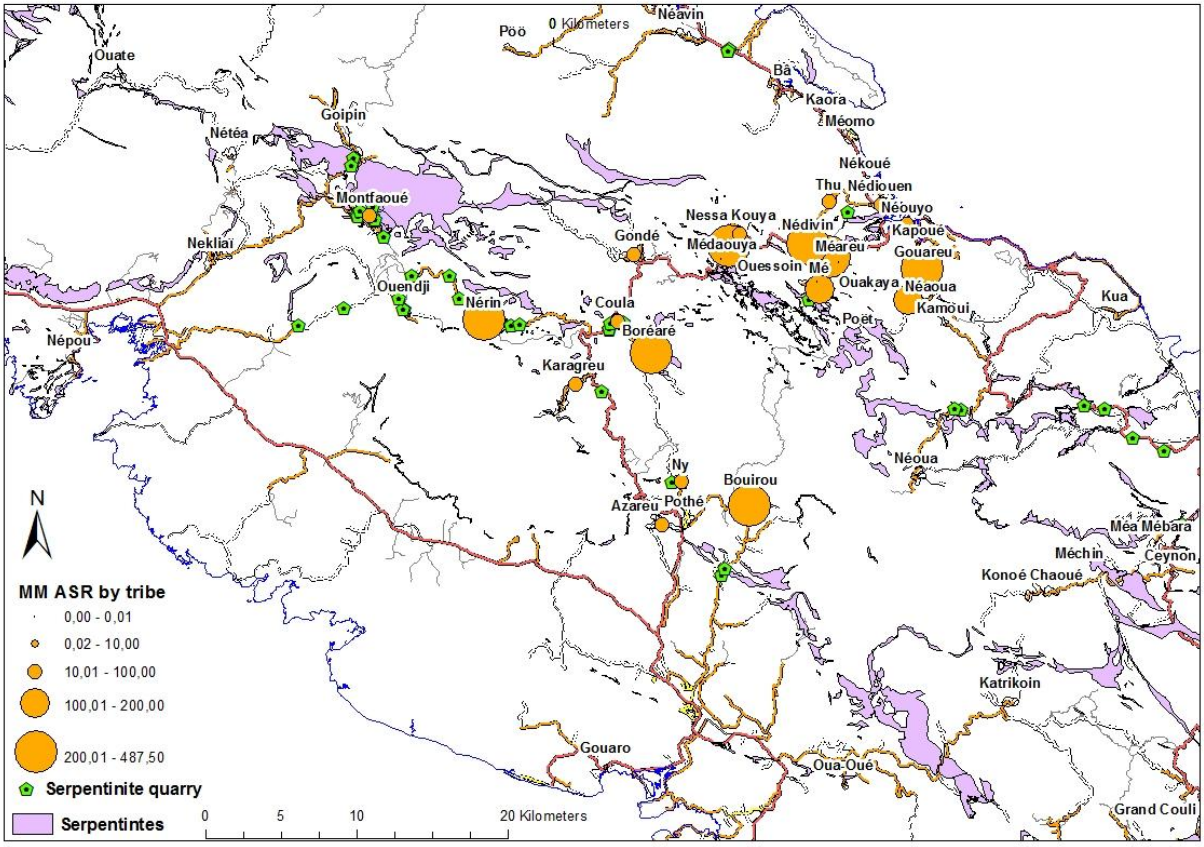
Tremolite



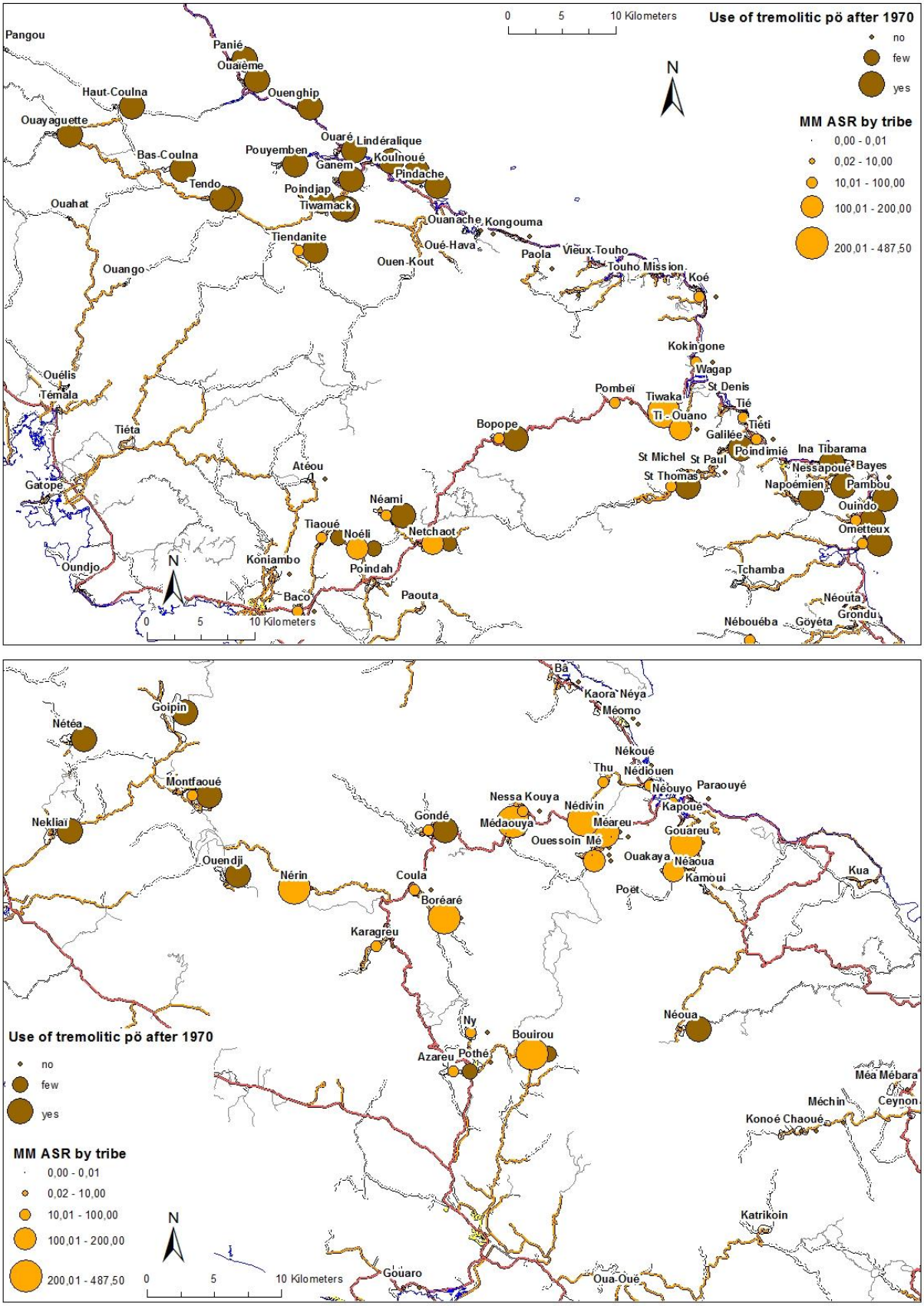
Chrysotile

Supplemental Material, Figure 4 – Maps of Houaïlou-Bourail-Poya and Kone-Poindimié-Touho-Hienghène areas, serpentinite outcrops, quarries of serpentinite and ASR of MM by tribe, 1984-2008

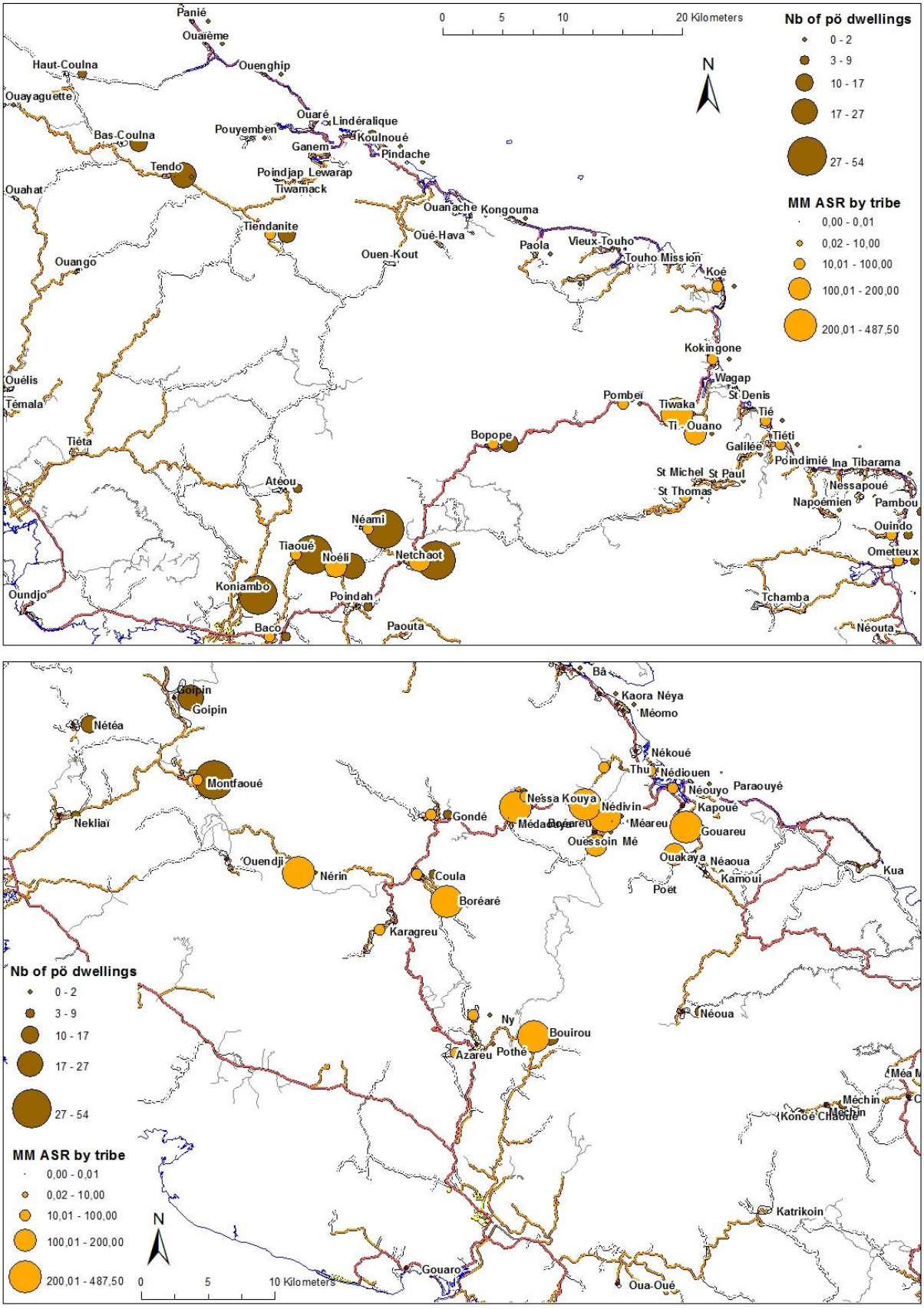
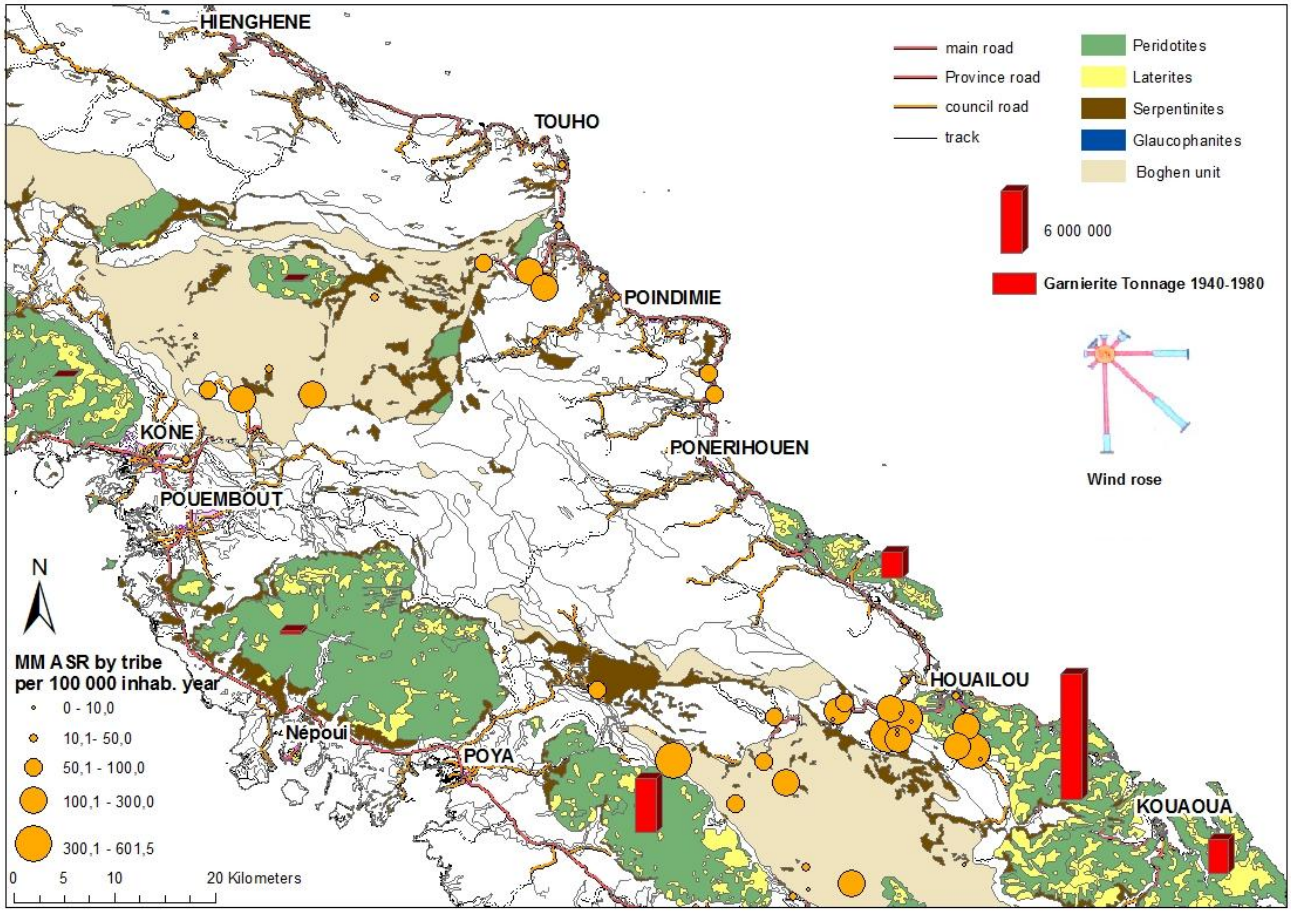




Supplemental Material, Figure 5 - Maps of Houaïlou-Bourail-Poya and Kone-Poindimié-Touho-Hienghène areas, use of tremolitic Pö and standardized incidence of MM by tribe, 1984-2008



Supplemental Material, Figure 6 – Maps of Houaïlou-Bourail-Poya and Kone-Poindimié-Touho-Hienghène areas, number of dwellings covered with tremolitic Pö and standardized incidence of MM by tribe, 1984-2008



Supplemental Material, Figure 7 – Study area, geological map of asbestos bearing units, tonnage of garnierite extracted 1940-1980, main roads and MM ASR by tribe (residence 30 years before diagnosis), 1984-2008