

附录I 低温环境中细菌与古菌的主要类群  
Appendix I Main phyla of the psychrophiles in cold environments

样品来源 Site and sample	类群 Group		参考文献 Reference
	科以上类群 Group above family	属及种 Genus and species	
<b>冰川冰芯及沉积物</b>			
<b>南极</b>			
Vostok湖5G冰芯	$\alpha$ -Proteobacteria, Actinobacteria, Firmicutes		D'Elia <i>et al.</i> , 2008
Vostok湖3593米冰芯	$\alpha$ -和 $\beta$ -Proteobacteria, HGC, LGC及CFB类群	<i>Brachybacteria, Methylobacterium, Paenibacillus, Sphingomonas</i>	Christner <i>et al.</i> , 2001
Dronning Maud Land浅层冰芯		<i>Methylobacterium, Brevundimonas, Paenibacillus, Bacillus, Micrococcus, Bacillus aryabhatai</i>	Antonya <i>et al.</i> , 2012
Canada 冰川冰尘穴		<i>Acidobacterium, Actinobacteria, Cyanobacteria, Cytophagales, Gemmimonas, Planctomycetes, Proteobacteria, Verrucomicrobia</i>	Christner <i>et al.</i> , 2003a
Lower Wright冰川沉积物		<i>Proteobacteria, Firmicutes, Acidobacteria, Cyanobacteria, Bacteroidetes, Planctomycetes, candidate division OP10</i>	Stibal <i>et al.</i> , 2012
Bratina岛冰川融水湖沉积物	$\alpha$ -, $\beta$ -和 $\gamma$ -Proteobacteria, CFB类群, Spirochaetaceae, Actinobacteria, Crenarchaeota		Sjöling & Cowan, 2003
<b>北极</b>			
GISP2冰芯	$\alpha$ -, $\beta$ -和 $\gamma$ -Proteobacteria, HGC, LGC及CFB类群,	<i>Methylobacterium, Rhodococcus, Mycobacterium, Sphingomonas, Arthrobacter, Frigoribacterium, Thermus</i> 及厌氧的 <i>Bacteroides, Eubacterium, Clostridium</i>	Sheridan <i>et al.</i> , 2003; Miteva <i>et al.</i> , 2004; Tung <i>et al.</i> , 2006
格陵兰岛Russell冰川	Proteobacteria		Stibal <i>et al.</i> , 2012
<b>青藏高原</b>			
马兰冰川冰芯	$\alpha$ -, $\beta$ -和 $\gamma$ -Proteobacteria, CFB类群, Acinetobacter, HGC, LGC和其他类群细菌		马晓军, 2004; 向述荣等, 2004; Zhang <i>et al.</i> , 2001
慕士塔格冰川冰芯	$\alpha$ -和 $\gamma$ -Proteobacteria, CFB类群, HGC	<i>Acinetobacter, Cryobacterium, Flavobacterium</i>	Xiang <i>et al.</i> , 2005
<b>雪</b>			
南极表层雪和常年积雪		<i>Deinococcus-like</i>	Carpenter <i>et al.</i> , 2000
珠穆朗玛峰地区果曲、东绒布、扎当和帕隆4号冰川	$\alpha$ -, $\beta$ -和 $\gamma$ -Proteobacteria, Actinobacteria, Bacteroidetes	<i>Sphingomonas, Polaromonas, Acinetobacter, Hymenobacter, Acinetobacter, Enterobacter, Rhizobium, Actinobacteria</i> 中的11个属	Liu <i>et al.</i> , 2009b
Yala冰川的表层雪	Cyanobacteria, $\alpha$ -Proteobacteria, Firmicutes, CFB类群		Liu <i>et al.</i> , 2011
日本立山(Tateyama Mountain)五月雪坑		<i>Cryobacterium psychrophilum, Variovorax paradoxus, Janthinobacterium lividum</i>	Segawa <i>et al.</i> , 2005
珠穆朗玛峰地区东绒布冰川冰、雪	$\alpha$ -, $\beta$ -和 $\gamma$ -Proteobacteria, Actinobacteria, Firmicutes, CFB类群, Cyanobacteria, TM7	<i>Acinetobacter, Leclercia</i>	刘勇勤等, 2006
<b>冻土及寒冷带</b>			
南极常年冻土	$\alpha$ -proteobacteria, HGC	<i>Fibrobacter, Acidobacterium, Arthrobacter, Nocardioides, Bacillus, Caulobacter, Comamonas, Flavobacterium, Pseudomonas, Sphingobacterium</i> , 另外还存在 <i>Nitrospina</i> 、green non-sulfur bacteria及其近缘细菌, <i>Fibrobacter, Acidobacterium</i> 和CFB类群的属	Gilichinsky <i>et al.</i> , 2007
西伯利亚冻土和冰沼土、加拿大北极高纬度地带和南极Dry Valley岩石和土壤		<i>Bacillus, Mycobacteria, Micrococcus, Brevibacterium, Planococcus, Arthrobacter, Clavibacter, Friedmanniella</i>	Christner <i>et al.</i> , 2000

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	科以上类群 Group above family	属及种 Genus and species	
喜马拉雅山Pindari冰川的3个土壤样品P1S、P4S和P8S	Actinobacteria, Firmicutes, Proteobacteria, Acidobacteria, Bacteroidetes, Gemmatimonadetes, Planctomycetes		Shivaji <i>et al.</i> , 2011
阿尔卑斯山冻土带早融雪位点(ESM)和晚融雪位点(LSM)土壤	ESM: Acidobacteria, Actinobacteria, $\alpha$ -proteobacteria LSM: Acidobacteria		Zinger <i>et al.</i> , 2009
<b>湖泊、湿地及藻丛</b>			
珠穆朗玛峰两个冰碛湖和两个冰川融水湖	$\alpha$ -, $\beta$ -和 $\gamma$ -Proteobacteria, CFB类群, Actinobacteria, Planctomycetes, Verrucomicrobia, Fibrobacteres, Eukaryoticchloroplast		Liu <i>et al.</i> , 2006
南极McMurdo Dry Valleys地区8–26539龄藻丛	Actinobacteria, Bacteroidetes, Firmicutes, Cyanobacteria, Proteobacteria, <i>Deinococcus-Thermus</i> 类群	<i>Sporosarcina</i>	Antibus <i>et al.</i> , 2012
青藏高原若尔盖湿地		<i>Methanobolus psychrophilus</i> R15	Zhang <i>et al.</i> , 2008
<b>海冰和深海</b>			
南极海冰	$\alpha$ -和 $\gamma$ -Proteobacteria, CFB类群, 革兰氏阳性细菌, Chlamydiales和Verrucomicrobiales	<i>Colwellia</i> , <i>Shewanella</i> , <i>Marinobacter</i> , <i>Planococcus</i> , <i>Pseudoalteromonas</i> , <i>Psychrobacter</i> , <i>Halomonas</i> , <i>Pseudomonas</i> , <i>Hyphomonas</i> , <i>Sphingomonas</i> , <i>Arthrobacter</i> , <i>Halobacillus</i> , 与 <i>Colwellia</i> 和 <i>Alteromonas</i> 近缘的新的系统发育类群及CFB类群中的一些属	Bowman <i>et al.</i> , 1997; Brown & Bowman, 2001
北极Chukchi Sea浮冰	Proteobacteria, CFB类群	<i>Alteromonas</i> , <i>Colwellia</i> , <i>Glaciecola</i> , <i>Octadecabacter</i> , <i>Pseudoalteromonas</i> , <i>Shewanella</i> , <i>Cytophaga</i> , <i>Flavobacterium</i> , <i>Gelidibacter</i> , <i>Polaribacter</i>	Junge <i>et al.</i> , 2002
北极海冰的多年冰	$\alpha$ -和 $\gamma$ -proteobacteria, CFB类群		Bowman <i>et al.</i> , 2012
不同地区深海海水	$\gamma$ -Proteobacteria	<i>Shewanella</i> , <i>Photobacterium</i> , <i>Colwellia</i> , <i>Moritella</i> , <i>Psychromonas</i>	DeLong <i>et al.</i> , 1997
冲绳海槽南部的深海		<i>Alcanivorax</i> , <i>Bacillus</i> , <i>Cobetia</i> , <i>Halomonas</i> , <i>Methylarcula</i> , <i>Micrococcus</i> , <i>Myroides</i> , <i>Paracoccus</i> , <i>Planococcus</i> , <i>Pseudomonas</i> , <i>Psychrobacter</i> , <i>Sporosarcina</i> , <i>Wangia</i>	Dang <i>et al.</i> , 2009

CFB类群: *Cytophaga-Flavobacterium-Bacteroides*类群; HGC: 高G+C革兰氏阳性细菌; LGC: 低G+C革兰氏阳性细菌。  
CFB: *Cytophaga-Flavobacterium-Bacteroides* group; HGC: high G+C Gram positive bacteria; LGC: low G+C Gram positive bacteria.