

## SUPPLEMENTARY INFORMATION

## Supplementary Figures

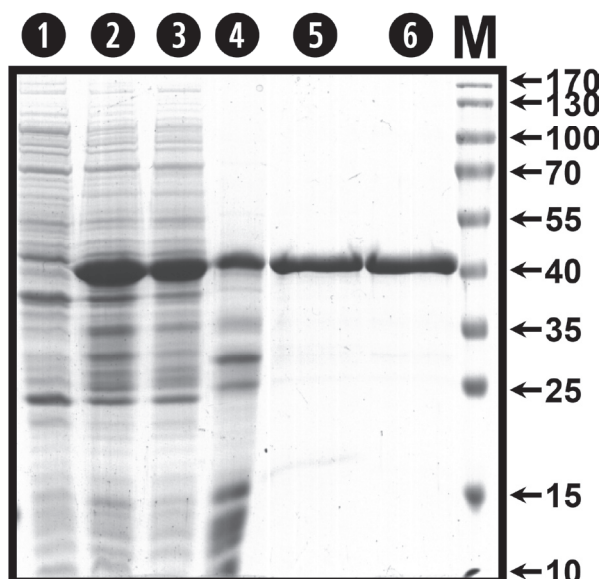


Figure S11 Purification of recombinant FBP aldolase/phosphatase of *I. hospitalis* from *E. coli* cells. SDS-PAGE of: lane 1, cells before induction; lane 2, cells after induction; lane 3, soluble fraction after ultracentrifugation at  $100,000 \times g$ ; lane 4, supernatant after 30 minutes of heat precipitation at  $80^\circ\text{C}$ ; lane 5, eluate after gel filtration; lane 6, eluate after MonoQ anion exchange chromatography; lane M, molecular mass markers (size in kDa).

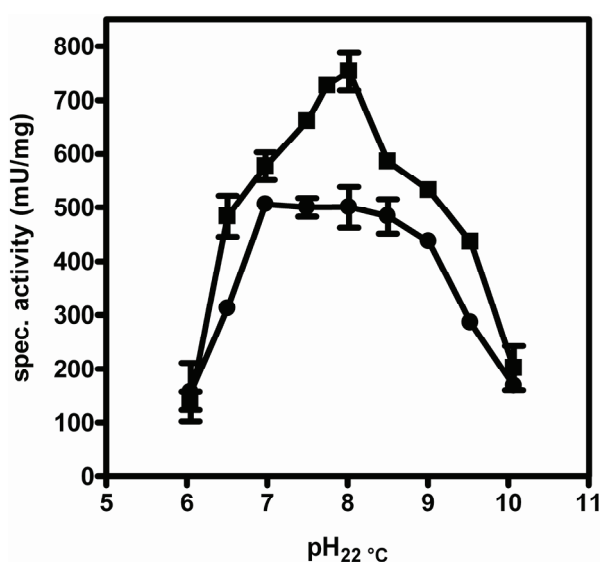


Figure S12 Effect of pH on FBP aldolase (●) and FBP phosphatase (■) activities of the FBP aldolase/phosphatase from *I. hospitalis*. Error bars represent the standard deviation of at least two independent measurements.

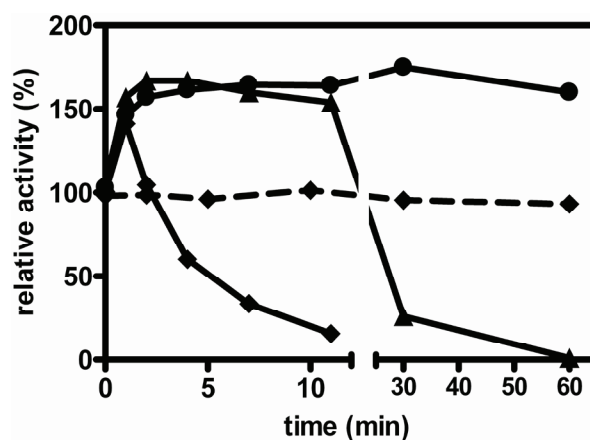


Figure S13 Heat stability of FBP aldolase/phosphatase from *C. symbiosum* and *I. hospitalis*. The *C. symbiosum* enzyme was incubated at  $97^\circ\text{C}$  (♦),  $82^\circ\text{C}$  (▲),  $67^\circ\text{C}$  (●) and the remaining activity was determined. For comparison the *I. hospitalis* enzyme (dashed line) was incubated at  $97^\circ\text{C}$ .

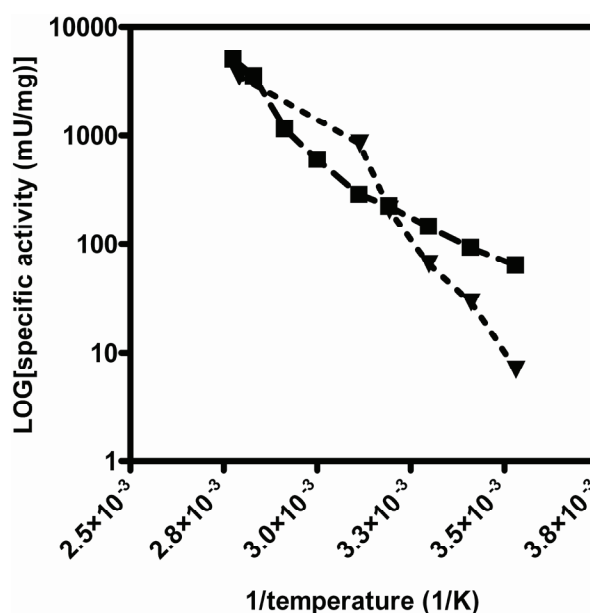


Figure S14 Temperature dependence of FBP aldolase/phosphatase activity. The graph shows an Arrhenius plot of FBP phosphatase activity of the hyperthermophilic *Ignicoccus* (▼) and the mesophilic *Cenarchaeum* (■) enzyme.

	10	20	30	40	50	60	70	80	90	100
Aciduliprofundum boonei 1	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	MDKITISLIKADVGGVPGHSTVHPDLIETAKEALQKAKDEHILEDPHVTVGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Aciduliprofundum boonei 2	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	MDKITISLIKADVGGVPGHSTVHPDLIETAKEALQKAKDEHILEDPHVTVGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Aeropyrum pernix	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	MSGRTTTSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Aquifex aeolicus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSLIKADIGGFGVHSSHPDVAVREHVEKEVEKGNLIDCDLITCGDDIAIVMTHRGGVDSSEIHK-LAWNTFEKA								
Archaeoglobus fulgidus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MRKVTVSLIKADVGSVAGHTTVPDELKKAEBENLKNVDSGLIIDFRVFNAGDDLELLMTHRGGVDSSEIHK-LAWNTFEKA								
Bradyrhizobium japonicum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MRLTVSLIKADVGSVGGHTKPSRRMATEVEGEVAKAICNGLLIDGFCITGDDIAIVMTHRGGVDSSEIHK-LAWNTFEKA								
Caldivirga maquilingensis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	MAPKTTVSVIKADIGGIPGHAMVHPKILEYASSRRLRAVKSGLLIDYVFNAGDDMSLIMTHRRKGVDSSEIHK-LAWNTFEKA								
Candidatus Desulforudis audax	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	MDKTTVSLIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Candidatus Korarchaeum cryptof	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MVRTTVSVIKADIGGLAGHHVHPKLEIAASELAEAKSSRIEDFYITVSGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Candidatus Methanoregula boone	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MPKTTVSVIKADVGSFPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Carboxyibrachium pacificum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MS-KITVTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Carboxythermus hydrogenoform	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MG-KITVTVSVIKADVGSFPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Cenarchaeum symbiosum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----VRIITVSAIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Coxiella burnetii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MEITVSAIKADVGSIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Dehalococcoides ethenogenes	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSLIKADIGGFGVHSSHPDQCLVRAEKHLAEAKKGNLIDYHITKCGDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Dehalococcoides sp.	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSLIKADIGGFGVHSSHPDQCLVRAEKHLAEAKKGNLIDYHITKCGDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Desulfurococcus kamchatkensis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MGMKITVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Hydrogenivirga sp.	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKITVTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Hydrogenobaculum sp.	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKITVTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Hyperthermus butylicus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MGEERRVTVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Ignicoccus hospitalis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAQKTTVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Metallosphaera sedula	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MRSTVTVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Methanobrevibacter smithii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVTVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Methanocaldococcus jannaschii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MSRMENKTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Methanococcus aeolicus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MHGEKITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Methanococcus maripaludis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MEEKVTVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Methanococcus vannielii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MGEKITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Methanococcus voltae	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MEEKITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Methanoculleus marisnigri	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MVKTTVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Methanopyrus kandleri	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MVSVAEEKVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Methanoseta thermophila	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MSKVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Methanosphaera stadtmanae	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Methanothermobacter thermautot	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Moorella thermoacetica	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MGERITVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Natronaerobius thermophilus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKITVTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Nitrococcus mobilis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKITVTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Nitrosopumilus maritimus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MENKTTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Pelotomaculum thermopropionicu	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MGSKTVTVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Petrotoga mobilis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKSQVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Picrophilus torridus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSLIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Pyrobaculum aerophilum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Pyrobaculum arsenaticum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MRLITLTKVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Pyrobaculum caldifontis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Pyrobaculum islandicum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Pyrococcus abyssi	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADVGGVPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Pyrococcus furiosus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADVGGVPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Pyrococcus horikoshii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	MVINSINLWLFSEVAVMAGEKITVSVIKADVGGVPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Roseiflexus castenholzii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAAELTISCIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Roseiflexus sp.	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAAELTISCIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Saccharopolyspora erythraea	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MVTLSIHKADTGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Staphylothermus marinus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MSEGEKITVSVIKADVGGVPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Sulfolobus acidocaldarius	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Sulfolobus islandicus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Sulfolobus solfataricus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Sulfolobus tokodaii	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSLAGHRRVHPDITLAAASRVLAERAKRKGVIKSFYVFNAGDDDLQIMTHRRKGVDSSEIHK-LAWNTFEKA								
Syntrophus aciditrophicus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADVGGVPGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Thermoanaerobacter pseudethano	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MS-KITVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermoanaerobacter tengcongens	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MS-KITVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermococcus barophilus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermococcus gammatolerans	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermococcus kodakarensis	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermococcus onnurineus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermococcus sp.	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MAVGEKITVSVIKADIGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermofilum pendens	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Thermoplasma acidophilum	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSHIKADIGSLPGHSLVDEKVMERIEYEDHGKN-LVSDFRMAHVGDQAQITMVTHTKGVDSSEIHK-LAWNTFEKA								
Thermoplasma volcanium 1	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSHIKADIGSLPGHSLVDEKVMERIEYEDHGKN-LVSDFRMAHVGDQAQITMVTHTKGVDSSEIHK-LAWNTFEKA								
Thermoplasma volcanium 2	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKVTVSHIKADIGSLPGHSLVDEKVMERIEYEDHGKN-LVSDFRMAHVGDQAQITMVTHTKGVDSSEIHK-LAWNTFEKA								
Thermoproteus neutrophilus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MRVTVSVIKADVGGFGVHSSHPDLELAKKAGILSG---SPLLIDFHVTVGDDINLILTHELGRNNGEITHG-LAWNTFEKA								
Thermoproteus tenax	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Thermus aquaticus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
Thermus thermophilus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADIGSFGHSHRAHPKLEIAAQLRAE-RGKLLDSFVTVGDDLELVMTSHRGGVDSSEIHK-LAWNTFEKA								
uncultured crenarchaeote	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
uncultured marine crenarchaeot	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
uncultured marine crenarchaeot	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
uncultured marine crenarchaeot	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	-----MKTITVSVIKADVGGIGGHTLPSGGLLDAVRRKVS---SSS-LLIDHYIGYCGDDSHVIMTHRRKGVDSSEIHK-LAWNTFEKA								
Consensus	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....	T S I K A D G G H D G D D H G H - A W								

	110	120	130	140	150	160	170	180	190	200
Aciduliprofundum boonei 1	TA-VAKELKLYGAGD	LLKDAFSGNIRG	MGPGAEME	ITR-----	KSEPIVAFMMDKTE	PGAFNLPYIRI	FADPFNTA	GLVIDP	SMHGGFKF	FEVMDIM
Aciduliprofundum boonei 2	TA-VAKELKLYGAGD	LLKDAFSGNIRG	MGPGAEME	ITR-----	KSEPIVAFMMDKTE	PGAFNLPYIRI	FADPFNTA	GLVIDP	SMHGGFKF	FEVMDIM
Aeropyrum pernix	TK-VAKDLGLYAGQD	LLSDAFSGNIRG	LGPGVAEME	FVER-----	PSEPIVVFMAADKTE	PGAFNLPYKIF	FADPFNTA	GLVIDP	RLHGGFIF	FEVLDVF
Aquifex aeolicus	TE-VAKKLLYAGQD	LLTDFSGNVRG	MGPGVAEME	FEEER-----	PSEPIVVFADKTE	SPSAWNLPLY	EMFADPFNTA	GLVIDP	KMHGGFTE	FEVLDVY
Archaeoglobus fulgidus	AG-IAKELKLYGAGD	LLKDAFSGNVRG	LGPGVAEME	FEEER-----	KAEPIVAFMMDKTE	PGAFNLPYIRI	FADPFNTA	GLVIDP	SMHGGFKF	FEVMDIM
Bradyrhizobium japonicum	TS-VAKTSGLYAGQD	LLADAFSGNIRG	AGPVAEL	SFDHS--LSGARPAES	FMVFAADKCG	PAYNLPLY	LAFADPMY	CAGLMLP	PMIK--G	FRFHVIMD
Caldivirga maquilingensis	TENYAKFKLYGAGD	LLKDAFSGNVRG	LGPGVAEME	FEEER-----	PSEPLIFAADKTE	PGAYNLPMY	KIFADPFNTA	GLVIDP	QMHGGFR	FEIDVY
Candidatus Desulforudis audax	TE-VAKKLLYAGQD	LLGDAFSGNIRG	LGPGVAE	IEVVER-----	KSEPIVFLMADKTE	PGAWNLPLY	RIFADPFNTA	GLVIDP	NMHGGFNF	FEVRLDI
Candidatus Korarchaeum cryptof	AD-AAKELGLYAGQD	LLKDAFSGNIRG	MGPGVAEME	FEEER-----	PSPDIVVFMAADKTE	PGAFNLPYKIF	FADPFNTA	GLVIDP	DKLHSGF	IFFEIMDVI
Candidatus Methanoregula boone	TK-VAKRFLKLYGAGQD	LLAEAFD	IRELGP	VAEME	FEEER-----	ESDPVLFMAADKTE	PGAWNFYLY	KIFADPFNTA	GLVIDP	SLGGFVFEVHD
Carboxydibrachium pacificum	TE-RARELKLYGAGQD	LLKDAFSGNIRG	MGPGVAEME	FEEER-----	KSEPVVIFIAADKTE	PGAWNLPLY	KMFADPFNTA	GLVIDP	SMHGGFKF	FEVMDIM
Carboxydotherrna hydrogenoform	TE-VAKKLLYAGQD	LLADAFSGNVRG	LGPGVAEME	FEEER-----	TSEPIVFAADKTE	PGAWNLPLY	KMFADPFNTA	GLVIDP	KMHGGFKF	FEVLDLL
Cenarchaeum symbiosum	TR-VAKEEGLYAGQD	LLSDAFSGNVRG	MGPGVAE	LEFEEER-----	ANEAPVFAADKTE	PGAFNYPYR	FMVFDLS	NSLNTGL	IVNKS	LAEQVVINIMDVS
Coxiella burnetii	TE-VAKEQGNLYAGQD	LLVADAFSGNVRG	AGPVAE	IEFTLNPKSNYRPAES	FMIFAGDKC	PAGFNLPLY	LVFC	CDPMHNG	GILLNPKI	HLGWFTVIDMD
Dehalococcoides ethenogenes	TE-VAKELKLYGAGQD	LLCDAFSGNVRG	MGPGVAEME	LEER-----	PSEPIIFMAADKTE	SSGAWNLPLY	KMFADPFNTA	GLVIDP	ENMHGGF	SFSEVHDVK
Desulfurococcus kamchatkensis	TE-VAKELKLYGAGQD	LLCDAFSGNVRG	MGPGVAEME	LEER-----	PSEPIIFMAADKTE	SSGAWNLPLY	KMFADPFNTA	GLVIDP	ENMHGGF	SFSEVHDVK
Hydrogenivirga sp.	TK-VAKELKLYGAGQD	LLSEAFSGNVRG	LGPGVAE	LEMEER-----	EAEPIVTFHADKTE	PGAFNLPYR	VFADPFNTA	GLVIDP	KMHGGF	VFVLDVY
Hydrogenobaculum sp.	TE-VAKKLLYAGQD	LLTDFSGNIRG	LGPGVAEME	FEEER-----	PSEPIVVFADKTE	SPSAWNLPLY	EMFADPFNTA	GLVIDP	KMHGGF	VFVLDVY
Hyperthermus butylicus	AE-VAKELGLYAGQD	LLSDAFSGNIRG	MGPGVAEME	FEEER-----	PSEPIVVFMAADKTE	PGAFNLPYKIF	FADPFNTA	GLVIDP	DKLHSGF	IFFEIMDVI
Ignicoccus hospitalis	AE-VAKELGLYAGQD	LLSDAFSGNVRG	LGPGVAE	MEIEER-----	PSEPIVFAADKTE	PGAFNLPYKIF	FADPFNTA	GLVIDP	RLHGGF	VFVLDVY
Metallosphaera sedula	TK-VSKELGLYAGQD	LLSDAFSGNIRG	MGPGVAE	IELEIDER-----	PSEPIAFMAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGFKF	FEVMDIM
Methanobrevibacter smithii	TE-RARELKLYGAGQD	LLSDAFSGNIRG	MGPGVAE	MEFKER-----	PSPDVLVYCCDKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SLHGGF	VFVLDVY
Methanocaldococcus jannaschii	TK-VAKELKLYGAGQD	LLADAFSGNVRG	MGPGVAE	MEFVER-----	KSEPIVVFCCDKTE	PATFNPLY	KMFADPFNTA	GLVIDP	DSMISG	FKFVEVHDVY
Methanococcus aeolicus	TE-VAKELKLYGAGQD	LLSEGFSGNVRG	MGPGVAE	MEFVER-----	PSEPIVVFCCDKTE	PAAFNLPLY	RMFADPFNTA	GLVIDP	DKKMQG	GFDFVLDIY
Methanococcus maripaludis	TE-VAKELKLYGAGQD	LLSNFSGNVRG	LGPGVAE	MEFVER-----	PSEPIVVFCCDKTE	PAAFNLPLY	RMFADPFNTA	GLVIDP	DSMTS	GFRYEILDFV
Methanococcus vannielii	TS-VAKELKLYGAGQD	LLSNFSGNIRG	LGPGVAE	MEFVER-----	PSEPIVVFCCDKTE	PAAFNLPLY	RYKMFADPFNTA	GLVIDP	SMASG	FVFEVLDVM
Methanococcus voltae	TD-VAKELKLYGAGQD	LLSDAFSGNVRG	LGPGVAE	MEFVER-----	RSEPIVVFCCDKTE	PAAFNLPLY	RYKMFADPFNTA	GLVIDP	DSMTE	GFKFVEVMDII
Methanoculleus marisnigri	AG-LAKEMKLYGAGQD	LLGDAFSGNVRG	MGPGVAEME	FEEER-----	GSDPILVFMADKTE	PGAWNFYLY	KIFADPFNTA	GLVIDP	SLHGGF	VFVLDVY
Methanopyrus kandleri	TK-VAEDLKLYGAGQD	LLSDAFSGNVRG	LGPGVAE	MEFVER-----	PSEPIVVFCCDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Methanoseta thermophila	TA-EAKSLKLYGAGQD	LLCDAFSGNIRG	MGPGVAE	MEQFTR-----	DAEPIVAFMMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Methanosphaera stadtmanae	AE-VAKGLKLYGAGQD	LLSDAFSGNIRG	MGPGVAE	MEFKER-----	GSDPVFAACDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	SLHGGF	VFVLDVY
Methanothermobacter thermautot	TD-VARGLKLYGAGQD	LLSDAFSGNIRG	MGPGVAE	MEFKER-----	PSPDVIIFCCDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	SLHGGF	VFVLDVY
Moorella thermoacetica	TE-VAKELKLYGAGQD	LLSDAFSGNVRG	MGPGVAE	MEFEEER-----	KSEPIVFAADKTE	PGAWNLPLY	KMFADPFNTA	GLVIDP	SLHGGF	VFVLDVY
Natronaerobius thermophilus	TA-TAKKORLYGAGQD	LLSDAFSGNIRG	LGPGVAE	MEIEER-----	ENEPVLFVADKTE	PGAYNLPLY	LSFC	CDPMHNG	GLLSPKI	GGDFFTVMDVS
Nitrococcus mobilis	TE-VAQAQGLYAGQD	LLVQAFSA	ANVRG	MGPPVAE	MEIDER-----	PNEPFLFFAADKTE	PGAYNLPLY	LAFDPMYNS	GLILSP	TNMQGFRFVIMDVE
Nitrosopumilus maritimus	TQ-VAKEEGLYAGQD	LLKDAFSGNVRG	MGPGVAE	MEFEEER-----	PNEAPVFAADKTE	PGAFNYPYR	FMVFDLS	NSLNTGL	IVNKN	LADGVKINIMDVE
Pelotomaculum thermopropionicu	TK-IAKMKLYGAGQD	LLADAFSGNIRG	LGPGVAE	MEFEEER-----	NSEPIVVFMAADKTE	PGAWNLPLY	KMFADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Petrophila mobilis	TK-IAKELKLYGAGQD	LLSDAFSGNIRG	MGPGVAE	MEFEEER-----	GSETLVAFMMDKTE	PGSFNYPYR	KIFADPFNTA	GLVIDP	LLIDG	GFVFEVMDII
Picrophilus torridus	TK-IAKELKLYGAGQD	LLSDAFSGNVRG	LGPGVAE	MEIEER-----	KSEPIVVFMAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Pyrobaculum aerophilum	TEQVAKKLYGAGQD	LLKDAFSGNVRG	MGPGVAE	MEFEEER-----	PSEPIVVFMAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Pyrobaculum arsenaticum	TEQVIAKFKLYGAGQD	LLKDAFSGNVRG	MGPGVAE	MEFEEER-----	PSPDILVFAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Pyrobaculum calidifontis	TEQVAKKLYGAGQD	LLKDAFSGNIRG	LGPGVAE	MEFEEER-----	PSEPLIFAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Pyrobaculum islandicum	TEQVAKKLYGAGQD	LLKDAFSGNIRG	LGPGVAE	MEIEER-----	PSEPIVVFMAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Pyrococcus abyssi	TE-VAKELALYAGQD	LLKDAFSGNVRG	MGPGVAE	MEITLR-----	KSEPIVTFHLDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	KMHGGF	VFVLDVY
Pyrococcus furiosus	TE-VAKELGLYAGQD	LLKDAFSGNVRG	LGPGVAE	MEITLR-----	KSEPIVTFHLDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	KMHGGF	VFVLDVY
Pyrococcus horikoshii	TE-VAKELGLYAGQD	LLKDAFSGNVRG	LGPGVAE	MEITLR-----	KSEPIVTFHLDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	KMHGGF	VFVLDVY
Roseiflexus castenholzii	TR-VAKELKLYGAGQD	LLKDAFSGNVRG	MGPGVAE	MEITLR-----	LSEPIVVFADKTE	SAGAWNLPLY	RMFADPFNTA	GLVIDP	SAMHGGF	VFVLDVY
Roseiflexus sp.	TR-VAKELKLYGAGQD	LLKDAFSGNVRG	MGPGVAE	MEITLR-----	PSEPIVVFADKTE	SAGAWNLPLY	RMFADPFNTA	GLVIDP	SAMHGGF	VFVLDVY
Saccharopolyspora erythraea	TG-IAKRLGLYAGQD	LLSDAFSGNIRG	MGPGVAE	LEFEEER-----	PSEPVVFLADKTE	PGAWNLPLY	KIFADPFNTA	GLVIDP	AKMHAG	FRFVEVLDY
Staphylothermus marinus	AK-VAKELKLYGAGQD	LLSDAFSGNVRG	LGPGVAE	MEIEER-----	KATVITFFHADKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Sulfolobus acidocaldarius	AK-VAKELGLYAGQD	LLSDAFSGNVRG	LGPGVAE	IEVEER-----	PSEPIAFMAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Sulfolobus islandicus	AK-VAKDLGLYAGQD	LLSDAFSGNVRG	MGPGVAE	IEVEER-----	PAEPVVFMAADKTE	PGAYNLPLY	KIFADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Sulfolobus solfataricus	AK-IAKDLGLYAGQD	LLSDAFSGNVRG	MGPGVAE	IEVEER-----	PAEPVVFMAADKTE	PGAYNLPLY	KIFADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Sulfolobus tokodaii	AK-VAKDLGLYAGQD	LLSDAFSGNVRG	LGPGVAE	IEIEER-----	ASEPIAFMAADKTE	PGAYNLPLY	KMFADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Syntrophus aciditrophicus	TK-VAKEQGLYAGQD	LLKDAFSGNVRG	MGPGVAE	MEFEEER-----	PNEPFLFFAADKTE	PGAYNLPLY	LAFDPMYNS	GLILSP	TNMQGFRF	VIMDVE
Thermoanaerobacter pseudethano	GE-KAKELKLYGAGQD	LLKDAFSGNIRG	LGPGVAE	MEIEER-----	KSEPIVIFMAADKTE	PGAWNLPLY	KMFADPFNTA	GLVIDP	NMHGGF	VFVLDVY
Thermoanaerobacter tengcongens	TE-RARELKLYGAGQD	LLKDAFSGNIRG	MGPGVAE	MEFEEER-----	KSEPVVIFIAADKTE	PGAWNLPLY	KMFADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Thermococcus barophilus	TK-TAKELGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEITLR-----	KSEPIVTFHMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	NMHGGF	VFVLDVY
Thermococcus gammatolerans	TK-VAKELGLYAGQD	LLKDAFSGNVRG	MGPGVAE	MEITLR-----	KSEPVVTFHMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	NMHGGF	VFVLDVY
Thermococcus kodakarensis	TK-VAKELGLYAGQD	LLKDAFSGNVRG	MGPGVAE	MEITLR-----	KSEPVVTFHMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	NMHGGF	VFVLDVY
Thermococcus onnurineus	TE-IAKELGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEITLR-----	KSEPIVTFHMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	NMHGGF	VFVLDVY
Thermococcus sp.	TK-VAKELGLYAGQD	LLKDAFSGNVRG	MGPGVAE	MEITLR-----	KSEPIVTFHMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	NMHGGF	VFVLDVY
Thermofilum pendens	TEKVSPLKLYGAGQD	LLKDAFSGNIRG	MGPGVAE	MEFEEER-----	RSEPIVLFVADKTE	PGAWNFYLY	KIFADPFNTA	GLVIDP	PAMHGGF	VFVLDVY
Thermoplasma acidophilum	TE-VAKLLGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEITLR-----	PSEPIVYVMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Thermoplasma volcanium 1	TE-VAKLLGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEITLR-----	PSEPIVYVMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Thermoplasma volcanium 2	TE-VAKLLGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEITLR-----	PSEPIVYVMDKTE	PGAFNLPYR	IFADPFNTA	GLVIDP	TMHGGF	VFVLDVY
Thermoproteus neutrophilus	TDQIAKRFKLYGAGQD	LLKDAFSGNIRG	MGPGVAE	MEFEEER-----	PSEPIIAFAADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	SMHGGF	VFVLDVY
Thermoproteus tenax	TEKIAKFKLYGAGQD	LLKDAFSGNIRG	MGPGVAE	MEIEER-----	PSEPIVTFADKTE	PGAFNLPYKMF	FADPFNTA	GLVIDP	PAMHGGF	VFVLDVY
Thermus aquaticus	TE-VAKREGLYAGQD	LLKDAFTGNL	RGPGVAE	MEFAER-----	PSEPFMVLAADKTE	PGAFNLPYLA	FADPMYSS	GLLLS	PELRG	GFRRIMDLA
Thermus thermophilus	TE-VAKREGLYAGQD	LLKDAFTGNL	RGPGVAE	MEFAER-----	PSEPFMVLAADKTE	PGAFNLPYLA	FADPMYSS	GLLLS	PELRG	GFRRIMDLA
uncultured crenarchaeote	TQ-VAKDEGLYAGQD	LLKDAFSGNVRG	MGPGVAE	LEFEEER-----	PNEAPVFAADKTE	PGAFNYPYR	FMVFDLS	NSLNTGL	IVNKS	LAEQVVINIMDVE
uncultured marine crenarchaeot	TK-VAKEEGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEFEEER-----	PNEVTFVFAADKTE	PGAFNYPYR	IFVFDLS	NSLNTGL	IVNKS	LAEQVVINIMDVE
uncultured marine crenarchaeot	TK-VAKEEGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEFEEER-----	PNEVTFVFAADKTE	PGAFNYPYR	IFVFDLS	NSLNTGL	IVNKS	LAEQVVINIMDVE
uncultured marine crenarchaeot	TK-VAKEEGLYAGQD	LLKDAFSGNIRG	MGPGVAE	MEFEEER-----	PNEVTFVFAADKTE	PGAFNYPYR	IFVFDLS	NSLNTGL	IVNKS	LAEQVVINIMDVE

A LY AGQDLL F SGN I R G M G P G V A E M E I T R ----- D K T A N F D G L G D



	210	220	230	240	250	260	270	280	290	300																																																			
Aciduliprofundum boonei 1	EHKK	---	VIMHSPKEM	YD	LLALIGAKS	RYVIKRV	YATESNPKVK	GEVVAVV	STEKLYI	QIAGEY	SKDDF	VALVRAQ	SGCPALG	EVLEPF	FAPP	HLVSG																																													
Aciduliprofundum boonei 2	EHKK	---	VIMHSPKEM	YD	LLALIGAKS	RYVIKRV	YATESNPKVK	GEVVAVV	STEKLYI	QIAGEY	SKDDF	VALVRAQ	SGCPALG	EVLEPF	FAPP	HLVSG																																													
Aeropyrum pernix	EGKA	---	VELRAPPEI	YD	LLALIGT	PSRYV	VKRVYRKS	---	DREIAAV	VSSERL	SLIAGRY	YVSKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVAG																																												
Aquifex aeolicus	TGKA	---	VKLNTPAE	YD	LLALIGS	VKRYV	VVKNVYRD	---	GEIAA	TASTQ	RSLIAGQ	YVYKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVAG																																												
Archaeoglobus fulgidus	ESKR	---	VFMRTPEE	YD	LLALIGG	KSRFV	IKRVYK	KEGKLP	PADEP	VAVISTE	KLYEVAG	YVYKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVSG																																												
Bradyrhizobium japonicum	NTAG	---	DSLLEL	PA	DDSYH	IAALLR	DNRF	GIDRI	ISRTHG	---	EVVVA	VSAQR	LHAIAG	KYVYK	SKDDF	VMIVRNQ	GIFPAP	BEIIS	PF	AKA	HFVGG																																								
Caldivirga maquilingensis	EGRV	---	YLLDAP	EH	YITL	GLIGT	PGRYI	IRRVYR	RS	---	DLTQA	AVVSV	ERLNL	IAGRY	YVSKDDF	VMIVRAQ	HGLPA	VGEVLE	EAF	FAPP	HLVGG																																								
Candidatus Desulfurudis audax	AHKK	---	IIFSAP	EDI	YD	MLVFI	GAPGR	YAIKRV	FHKAN	---	GQIAA	SSSTQ	RNLMA	GRYV	YVSKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVSG																																									
Candidatus Korarchaeum cryptof	ESKV	---	VELSSP	ED	YD	LLALIG	TSPRY	VIKRVYR	KV	---	DREIAA	SISTT	RSLIAG	RYVYK	SKDDF	VMIVRAQ	AGFPAL	G	EVLEPF	FAPP	FLVAG																																								
Candidatus Methanoregula boone	AKRM	---	ITFSCP	EE	YD	LLALIG	SSSR	YV	IKRVYK	RD	---	GTIVAS	TSTQ	RNLTA	GRYVYK	SKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVAG																																								
Carboxydibrachium pacificum	EGKK	---	IVFNTPE	E	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	NEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVFG																																								
Carboxydotherrmus hydrogenoform	ENKK	---	IIFNTPE	E	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GEIAA	TSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVSG																																								
Cenarchaeum symbiosum	--KA	---	RTARLV	W	EDK	PIE	AALMY	PGRV	VSVET	RDG	---	EPIA	SAS	TRL	HNIAG	YVYK	SKDDF	HICLV	R	TQ	K	NP	F	ATE	EAG	S	F	SNP	HYVAG																																
Coxiella burnetii	YKGE	---	EDDR	I	Q	LSV	PER	SWD	V	ALLQ	N	DRY	AV	S	IR	S	RYK	PE	---	EQV	V	S	A	T	R	L	H	N	I	A	G	Y	V	Y	K	SK	DD	F	H	A	I	R	Q	S	G	F	P	A	E	I	E	P	A	S	T	I	N	Q	I	S	G
Dehalococcoides ethenogenes	ESKG	---	ISFNTPE	E	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Dehalococcoides sp.	ESKG	---	ITFNTPE	E	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Desulfurococcus kamchatkensis	EGRS	---	VLLKSP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	DNLLA	AVVSV	ERLNL	IAGRY	YVSKDDF	VMIVRAQ	HGLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Hydrogenivirga sp.	TGKA	---	VRLSTP	AE	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	GEIAA	TSTQ	RNLMA	GRYVYK	SKDDF	VMIVRSQ	SGFFAVG	EVLEPF	FAPP	HLVAG																																									
Methanococcus vannielii	TGKA	---	VKLNTP	AE	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Methanococcus voltae	EGKY	---	VVLNAP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	DNIEA	AVVSV	ERLNL	IAGRY	YVSKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVAG																																									
Methanococcus marisnigri	EDKG	---	VHLNTP	AE	YD	LLALIG	TSPRY	VIKRVYR	TKN	---	DGKIA	AVVSV	ERLNL	IAGRY	YVSKDDF	VMIVRAQ	SGFFAVG	EVLEPF	FAPP	HLVAG																																									
Methanopyrus kandleri	EGGS	---	VVLNAP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DNMIG	S	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVFG															
Methanoseta thermophila	EHRK	---	VILNTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Methanosphaera stadtmanae	GHHK	---	VFLDTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanothermobacter thermautot	GHHK	---	VFLDTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Moorella thermoacetica	QNKK	---	ILLNTP	KE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	T	S	A	D	K	L	S	K	V	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanococcus maripaludis	AHKK	---	VFLDAP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanococcus vannielii	EHRK	---	VFMTP	PE	E	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	ITAV	S	S	E	K	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanococcus voltae	DHKK	---	VLMSTP	VE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanococcus marisnigri	KRRK	---	ILFNTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GLI	A	S	T	Q	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanopyrus kandleri	DQKK	---	VILNTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	AB	R	I	A	A	V	T	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG											
Methanoseta thermophila	DHKK	---	VFMSCP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GLI	A	S	T	Q	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanosphaera stadtmanae	ENKK	---	VVMSCP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG																
Methanothermobacter thermautot	EHRK	---	VMA	C	P	E	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	IAA	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG														
Moorella thermoacetica	KNER	---	VEFSLP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Natranaerobius thermophilus	HTEQ	---	DRIIQ	L	N	T	P	E	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	EQA	A	A	A	S	T	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG											
Nitrococcus mobilis	HTAC	---	DRVIE	L	V	A	P	E	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	EQA	A	V	S	T	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG												
Nitrosopumilus maritimus	--KA	---	QIAELQ	W	EDK	PIE	AALMY	PGRV	VSVET	RDG	---	EPILA	S	A	S	T	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG															
Pelotomaculum thermopropionicu	ENKK	---	ITFSCP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Petrotoga mobilis	ERRK	---	IFLCP	DE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	GEIAA	VSTQ	RNLMA	GRYVYK	SKDDF	VMIVRCQ	GNLPA	VGEVLE	EAF	FAPP	HLVAG																																								
Picrophilus torridus	EGKR	---	IMLSL	P	E	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DEQ	A	V	A	T	S	T	Q	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG												
Pyrobaculum aerophilum	EHRK	---	VLLKTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DGAP	A	A	A	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG													
Pyrobaculum arsenaticum	EHRK	---	VLLKTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DGAP	A	A	A	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG													
Pyrobaculum caldicellulosum	EHRK	---	VLLKTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DGAP	A	A	A	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG													
Pyrobaculum islandicum	EHRK	---	VLLKTP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DGAP	A	A	A	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG													
Pyrococcus abyssi	EHRK	---	VIMNSP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DEQ	A	V	A	V	S	T	E	R	L	N	I	A	G	Y	V	Y	K	SK	DD	F	V	L	I	R	Q	H	G	F	P	A	E	A	F	F	AP	P	HLVAG													
Pyrococcus furiosus	EHRK	---	VIMNSP	EE	YD	LLALIG	TSPRY	VIKRVYR	TKA	---	DEQ	A	V	A	V	S	T	E	R	L	N	I	A	G	Y	V																																			

	310	320	330	340	350	360	370	380	390	400																																																
Aciduliprofundum boonei 1	WMRGS	HNGPL	MPLPV	SIKO	-----	AHCT	RDGPP	RVAA	LGFO	QVAN	-GKLV	GP-V	DLF	DDP	AFDR	ARE	TAQY	IADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Aciduliprofundum boonei 2	WMRGS	HNGPL	MPLPV	SIKO	-----	AHCT	RDGPP	RVAA	LGFO	QVAN	-GRLV	GP-V	DLF	DDP	AFDR	ARE	TAQY	IADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Aeropyrum pernix	WMRGS	HNGPL	MPLPV	GLKD	-----	SKVSR	FDGPP	RVIA	LGFO	VKN	-GELI	GP-V	DLF	DDP	AFDE	ARRQ	QAQI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Aquifex aeolicus	WMRGS	HNGPL	MPLPV	SFED	-----	ARPS	RDGPP	RVIA	LGAG	QLAN	-GKLI	GP-V	DMF	DDP	AFDK	ARQV	ADMA	ILRR	QGIF	EPHRL	PL	EE	ME	IT	-T																																	
Archaeoglobus fulgidus	WMRGS	HNGPL	MPLPV	PFKY	-----	SKCT	RDGPP	RVIA	LGAG	QLAN	-GKLI	GP-V	DMF	DDP	AFDY	TRQK	AMEI	AEY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Bradyrhizobium japonicum	DARG	SHVM	PLMPV	PLNT	-----	PVTG	MYC	LPV	SCV	GS	-IDR	EG	RF	AE	SY	TD	FF	DN	PA	WD	EV	RR	AR	QK	AE	IM	RS	QW	GS	GA	AM	LP	VSE	LE	YG	-G																						
Caldivirga maquilingsensis	WMRGS	HNGPL	MPLPV	SIVN	-----	SCPT	RDGPP	RVVA	LGFO	LAQ	-GKLI	GP-V	DMF	DDP	AFDR	ARAL	CNEI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Candidatus Desulfurudis audax	WMRGS	HNGPL	MPLPV	SERD	-----	ARPT	RDGPP	RVIA	LGFO	VKD	-SKLI	GP-V	DLF	DDP	AFDE	TRRM	ANFI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Candidatus Korarchaeum cryptof	WMRGS	HNGPL	LLPV	GLCD	-----	ANCT	RDGPP	RVVC	FGFO	QVAN	-GALV	GP-V	DLF	DDP	AFDR	VRAR	CNEI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Candidatus Methanoregula boone	WMRGS	HNGPL	MPLPV	SLED	-----	AVPT	RDGPP	RVCA	LGFO	LKE	-GKLI	GP-V	DLF	DDP	AFDS	ARKK	AEI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Carboxydibrachium pacificum	WMRGS	HNGPL	MPLPV	SVD	-----	ATPS	RDGPP	RVIA	LGFO	LAD	-GKLI	GP-V	DMF	DDP	AFDR	ARE	MAI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Carboxydotherrmus hydrogenoform	NTRG	SHM	PLMPV	RLNS	-----	PASIN	F	CIP	IV	EAL	V	SMH	-EG	RL	T	GP-V	DF	G	ST	P	DD	W	RR	T	AT	TR	RA	H	AM	RR	Q	GF	VH	PA	TV	LP	VE	LE	Y	AE	G																	
Cenarchaeum symbiosum	DARG	SHM	PLMPV	PVINT	-----	PVTG	Y	CP	LI	S	AL	G	F	S	M	N	K	Q	G	F	A	G	R	V	D	F	F	A	G	S	A	W	D	A	R	Y	V	S	R	R	A	E	I	R	R	G	F	M	I	A	M	A	E	I	A	V	T	-G
Dehalococcoides ethenogenes	WMRGS	HNGPL	MPLPV	SIED	-----	STPT	RDGPP	RVTA	LGFO	LSN	-GMLI	GP-V	DMF	DDP	AFDN	ARQ	KS	LDMA	DMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Dehalococcoides sp.	WMRGS	HNGPL	MPLPV	SIED	-----	STPT	RDGPP	RVTA	LGFO	LSN	-GMLI	GP-V	DMF	DDP	AFDN	ARQ	KS	LDMA	DMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Desulfurococcus kamchatkensis	WMRGS	HNGPL	MPLPV	PMRY	-----	ARVT	RDGPP	RVIA	LGWN	ISN	-GKLI	GP-V	DLF	DDP	AFDE	TRRL	AO	FI	AE	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																															
Hydrogenivirga sp.	WMRGS	HNGPL	MPLPV	SFED	-----	ARPS	RDGPP	RVIA	LGQ	LS	-GKLV	GP-V	DMF	DDP	AFDK	ARV	AO	DM	ILRR	QGIF	EPHRL	PL	EE	ME	IT	-T																																
Hydrogenobaculum sp.	WMRGS	HNGPL	MPLPV	GFED	-----	ATPS	RDGPP	RVIA	LGFO	QIAN	-GMLV	GP-V	DMF	DDP	AFDK	ARV	AO	DM	ILRR	QGIF	EPHRL	PL	EE	ME	IT	-T																																
Hyperthermus butylicus	WMRGS	HNGPL	MPLPV	SIRD	-----	ARCT	RDGPP	RVIA	LGFO	VTK	-GKLI	GP-V	DLF	DDP	AFDE	ARRL	AO	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Ignicoccus hospitalis	WMRGS	HNGPL	MPLPV	VRD	-----	ARPT	RDGPP	RVIA	LGFO	VKN	-AKLV	GP-V	DLF	DDP	AFDE	ARRT	ANK	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																																
Metallosphaera sedula	WMRGS	HNGPL	MPLPV	SQRD	-----	AKAT	RDGPP	RVIA	LGFO	VKN	-GKLT	GP-V	DLF	DDP	AFDE	TRRM	AS	VT	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																															
Methanobrevibacter smithii	WMRGS	HNGPL	MPLPV	SQD	-----	ANPI	RDGPP	RVIA	LGFO	VSE	-AKLI	GP-V	DLF	DDP	AFDP	TR	RES	ARI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-S																															
Methanocaldococcus jannaschii	WMRGS	HNGPL	MPLPV	GEE	-----	ATPT	RDGPP	RVIA	LGFO	VCD	-GMLI	GP-V	NDF	AD	KG	FK	ARE	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-S																				
Methanococcus aeolicus	WMRGS	HNGPL	MPLPV	GEDD	-----	ANPT	RDGPP	RVIA	LGFO	LSK	-GRLV	GP-V	NDF	AD	VG	FS	ARK	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-S																				
Methanococcus maripaludis	WMRGS	HNGPL	MPLPV	AEED	-----	AMPA	RDGPP	RVIA	LGFO	LSH	-GRLV	GP-V	NDF	AD	KS	FK	ARE	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-S																				
Methanococcus vannielii	WMRGS	HNGPL	MPLPV	AEED	-----	ARPA	RDGPP	RVIA	LGFO	LSH	-GRLV	GP-V	NDF	AD	KS	FK	ARE	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-S																				
Methanococcus voltae	WMRGS	HNGPL	MPLPV	GEE	-----	AMPS	RDGPP	RVIA	LGFO	LSK	-GRLV	GP-V	NDF	AD	VG	FS	ARK	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-S																				
Methanoculleus marisnigri	WMRGS	HNGPL	MPLPV	GVED	-----	ANCT	RDGPP	RVIA	LGFO	VCN	-GKLI	GP-V	DMF	DDP	AFDN	ARV	AO	DM	ILRR	QGIF	EPHRL	PL	EE	ME	IT	-T																																
Methanopyrus kandleri	WMRGS	HNGPL	MPLPV	SSEE	-----	AHPT	RDGPP	RVIA	LGFO	LRN	-GELV	GP-V	DLF	DDP	AFDR	AR	AE	VI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																															
Methanosacta thermophila	WMRGS	HNGPL	MPLPV	CAFED	-----	AHPT	RDGPP	RVIA	LGFO	LCN	-GLLI	GP-V	DLF	DDP	AFDL	TR	MR	VE	IT	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																														
Methanosphaera stadtmanae	WMRGS	HNGPL	MPLPV	SQAD	-----	ARPV	RDGPP	RVIA	LGFO	VSE	-AKLI	GP-V	DMF	DDP	AFDP	TR	ARN	T	AK	VA	N	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-S																													
Methanothermobacter thermautot	WMRGS	HNGPL	MPLPV	QAQRD	-----	ATPV	RDGPP	RVIA	LGFO	VAD	-GKLV	GP-V	DMF	DDP	AFDR	S	R	Q	L	A	E	V	A	E	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-S																										
Moorella thermoacetica	WMRGS	HNGPL	MPLPV	GLDQ	-----	SAPT	RDGPP	RVIA	LGFO	LSD	-GRLV	GP-V	DMF	DDP	AFDV	AR	Q	T	A	E	I	A	E	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-G																											
Natronaerobius thermophilus	FMRG	SHHG	PLMPV	KKNT	-----	VSYF	DGPP	RVIA	LGFO	CVS	-EG	KL	T	EP-V	DC	F	Q	P	DD	H	R	D	K	S	R	K	S	L	D	R	Q	F	G	S	A	M	L	P	V	S	E	L	E	Y	G													
Nitrococcus mobilis	WMRGS	HNGPL	MPLPV	CPLNT	-----	PVSY	DGPP	RVIA	LGFO	LAC	-EG	RL	T	EP-V	D	A	F	A	P	W	D	S	V	R	E	T	A	A	K	A	M	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-G									
Nitrosopumilus maritimus	NTRG	SHM	PLMPV	KLNS	-----	AATN	F	CIP	IV	EAL	V	SMH	-NG	KL	T	GP-V	DF	G	ST	P	DD	W	RR	T	AT	TR	RA	H	AM	RR	Q	GF	VH	PA	TV	LP	VE	LE	Y	AE	G																	
Pelotomaculum thermopropionicu	WMRGS	HNGPL	MPLPV	SVAQ	-----	SNPT	RDGPP	RVIA	LGFO	LSD	-GKLV	GP-V	DMF	DDP	AFDL	AR	Q	K	A	E	I	A	E	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																											
Petrotoga mobilis	WMRGS	HNGPL	MPLPV	SFKD	-----	AHCT	RDGPP	RVIA	LGFO	LSH	-GNFI	GP-V	DLF	DDP	AFDL	SR	K	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-T																				
Picrophilus torridus	WMRGS	HNGPL	MPLPV	SFKN	-----	SRMT	RDGPP	RVIA	LGFO	VLD	-GRLA	GP-V	DMF	DDP	AFDY	AR	T	K	AE	MA	I	R	R	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-A																				
Pyrobaculum aerophilum	WMRGS	HNGPL	MPLPV	ISVDPERRIAI	-----	GAKM	TRFDGPP	RVIA	LGFO	LHD	-GYLEG	GP-V	DLF	DDP	AFDY	VR	Q	AA	QI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-A																														
Pyrobaculum arsenaticum	WMRGS	HNGPL	MPLPV	ARFISIDPEKRIAI	-----	GAKM	TRFDGPP	RVIA	LGFO	LHD	-GYLEG	GP-V	DLF	DDP	AFDY	VR	Q	AA	QI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-A																														
Pyrobaculum caldifontis	WMRGS	HNGPL	MPLPV	AKFYHIDPEKRIAI	-----	GAKM	TRFDGPP	RVIA	LGFO	LHD	-GYLEG	GP-V	DLF	DDP	AFDY	VR	Q	AA	QI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-A																														
Pyrobaculum islandicum	WMRGS	HNGPL	MPLPV	ARFISIDPEKRIAI	-----	GAKM	TRFDGPP	RVIA	LGFO	LHD	-GYLEG	GP-V	DLF	DDP	AFDY	VR	Q	AA	QI	ADY	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-A																														
Pyrococcus abyssii	WMRGS	HNGPL	MPLPV	PLKY	-----	ATPT	RDGPP	RVIA	LGFO	QIS	-PE	G	L	I	GP-V	DLF	DDP	AFDY	AR	Q	K	A	E	I	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																										
Pyrococcus furiosus	WMRGS	HNGPL	MPLPV	PLKY	-----	ATPT	RDGPP	RVIA	LGFO	QIS	-PE	G	L	I	GP-V	DLF	DDP	AFDY	AR	Q	K	A	E	I	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																										
Pyrococcus horikoshii	WMRGS	HNGPL	MPLPV	PLKY	-----	ATPT	RDGPP	RVIA	LGFO	QIS	-PE	G	L	I	GP-V	DLF	DDP	AFDY	AR	Q	K	A	E	I	YRMR	HGPF	EPHRL	PL	EE	ME	IT	-T																										
Roseiflexus castenholzii	WMRGS	HNGPL	MPLPV	CRIGD	-----	AHPG	RDGPP	RVIA	LGFO	QIAE	-GRLI	GP-V	DMF	DDP	AFDE	AR	L	C	N	V	I	A	D	H	R	R	H	G	F	Q	P	H	R	L	P	A	T	M	E	I	T	-T																
Roseiflexus sp.	WMRGS	HNGPL	MPLPV	CRIGD	-----	AHPG	RDGPP	RVIA	LGFO	QIAE	-GRLI	GP-V	DMF	DDP	AFDE	AR	L	C																																								

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          410      420      430      440
...|...|...|...|...|...|...|...|
Aciduliprofundum boonei 1  LPKVLTKLDRFFEKIQ-----
Aciduliprofundum boonei 2  LPKVLTKLDRFFEKIQ-----
Aeropyrum pernix          LPEVLKRLKDRFFPVEMGY---KPKVKHE---SGEADVD
Aquifex aeolicus         LPKVLKLENRFDTEV-EKLESEQKIEKEDMD-----
Archaeoglobus fulgidus   LPKVLEKLKRFEV-----
Bradyrhizobium japonicum FRDTVSGLLKRFLRDRRPEAAE-----
Caldivirga maquilingensis LPQILSTLKPIPVEEYERNRLKYISEKISPVAIAGGSTGD
Candidatus Desulforudis audaxv MPLVMSKLKRFIDLRLSKTKS-----
Candidatus Korarchaeum cryptof LPEVLKLEGKFRHE-----
Candidatus Methanoregula boone LPAVEKLENRWKLLE-----
Carboxydibrachium pacificum LPHLMEKLKDRWEKD-----
Carboxydotherrmus hydrogenoform LPVLEKLKDRFVKA-----
Cenarchaeum symbiosum      YRSRMDVLDSKMVPLKDSGPAGTGR--AYEDPD
Coxiella burnetii         LVDTWKLDDEFELRKNG-----
Dehalococcoides ethenogenes MPQVSKLAGRFKPLED-----
Dehalococcoides sp.      MPQVSKLAGRFKPLKD-----
Desulfurococcus kamchatkensis LPVLEKLKDRFVKSEEEAKVVKHSDMLSGS-----
Hydrogenivirga sp.       LPKILKLENRFDIEE-QRLDKDQVIEKEDMD-----
Hydrogenobaculum sp.     LPKVIELSSRFFDVNNVSSDKSNMLVEDMD-----
Hyperthermus butylicus   LPQVLEKLKNRFAEAKDYEKYIKPKIKSELLTG-EETD
Ignicoccus hospitalis    LPQVLERLKDRFKPVKDLP---VPKVKSEMLSGAEEAHD
Metallosphaera sedula    LPTLEKLKPRFKKE---EDVKKAPSVYTSKDQGMD-----
Methanobrevibacter smithii LPQVMAKLEDRFEDME-----
Methanocaldococcus jannaschii VPKVLEALEDRFIPLEGLELIEEGGITRKDRGDVE-----
Methanococcus aeolicus   IKVVLALEDRFVPNEKH-EVVDKLTY--DVEDQS
Methanococcus maripaludis VPKVLAQLKDRFIDMEETCECKIDELR--ERGDME
Methanococcus vanniellii VPKVLAQLKGRFIDENCGCKIDQIR--NRGDME
Methanococcus voltae     VPKVLTLESRFEEIPEN-NCKLEKTT--DRGDLE
Methanoculleus marisnigri LPQVEKQFKDRWEDLPE-----
Methanopyrus kandleri    LPDVLKLEDRFEDLEE-----
Methanosaeata thermophila LPHVLKRLAERFEPAE-----
Methanosphaera stadtmanae LPQVLEKLEDRFEDM-----
Methanothermobacter thermautot LPQVLEKLGDRFEDME-----
Moorella thermoacetica   MPEVMAKLKNRFVKVDHRDDEPAAEELGAK-----
Natranaerobius thermophilus ITHKMEELEKRFDR-----
Nitrococcus mobilis     VAERIEQLRERFQNRTE-----
Nitrosopumilus maritimus YRARMDVLESKMKPMEGTD-SSGDRKENYEDPD-----
Pelotomaculum thermopropionicu MPEVSKRIKDRFEKLR-----
Petrogoba mobilis       LPQVLKLETRFEELE-----
Picrophilus torridus    LPKILEKLSSKFEKLSDLNELKEVQ-----
Pyrobaculum aerophilum  LPKILAKIKAYPADQYEKERRKYVEALVKGQKAEEAH-HD
Pyrobaculum arsenaticum LPKILAKIKAYPADQYEKERRKYIEAIVKGEKVGESQ-HD
Pyrobaculum calidifontis LPKILAKIKSYPADQYEKQRRKYVEEAIKGTPVEHSQ-HD
Pyrobaculum islandicum  LPKILAKVKSYPADQYEKERRKYIEAVVKGVKAEETQ-HD
Pyrococcus abyssi       LPQVLEKLKDRFEPIE-----
Pyrococcus furiosus     LPQVLEKLKDRFEPIE-----
Pyrococcus horikoshii   LPQVLEKLKDRFEPIE-----
Roseiflexus castenholzii LPEVMKLADRWQPVNGHAVSPEQVAYQ-----
Roseiflexus sp.         LPEVMKLADRWQPVNGHAVSGEVVETLPASVAS-----
Saccharopolyspora erythraea MATLEKRLADRWQPMEAAVPR-----
Staphylothermus marinus LPAVLEKLKDRFVKT-EEVHVIKRHSALLSGTSEEHD-
Sulfolobus acidocaldarius LPIILEKLSRRFKKE---SDVKVKSEISYSKESGPSGD-
Sulfolobus islandicus   LPLVIEKLKNRFKKE---TDMYKTKPSVYSHESSHE
Sulfolobus solfataricus LPLVIEKLKNRFKKE---TDMYKTKPSVYSHESSHE
Sulfolobus tokodaii     LPLILEKLKDRFKKE---SDVYKAKESIYAKESQGHD-
Syntrophus aciditrophicus IVEKMKILDERFKVRG-----
Thermoanaerobacter pseudethano LPHVVKLQRWKEE-----
Thermoanaerobacter tengcongens LPHLMEKLKDRWEKD-----
Thermococcus barophilus LPQVLEKLKDRFEPL-----
Thermococcus gammatolerans LPQVLKRLEERFEDIE-----
Thermococcus kodakarensis LPQVLKRLTDRFEPIE-----
Thermococcus onnurineus  LPQVLKRLEERFEDIE-----
Thermococcus sp.        LPQVLKRLEERFEDIE-----
Thermofilum pendens     LPSVLEKLKAR-----FVPAEAE-----
Thermoplasma acidophilum LPVMEKLKDRFVDIEKETLAK-----
Thermoplasma volcanium 1 LPAVVEKLKNRFVDIEKQEVAK-----
Thermoplasma volcanium 2 LPAVVEKLKNRFVDIEKQEVAK-----
Thermoproteus neutrophilus LPKILAKVKPYPADQYEKDRKKYIEAVVKGARVEESQ-HD
Thermoproteus tenax     LPKILAKIQSFSADDYEKNRQAYIKRALASAGLVEAQSHD
Thermus aquaticus       IAERLKALEREFS-----
Thermus thermophilus   IAERLKALEREFS-----
uncultured crenarchaeote YKARMSVLESKMKPMKEDKSNTDRKENYEDPD-----
uncultured marine crenarchaeot YKAVMDVLHSKMKPIQDQQ-QNDQRKESYEDPD-----
uncultured marine crenarchaeot YNAIMDVLHSKMKPIQDQP-QKDQRKESYEDPD-----
uncultured marine crenarchaeot YKDIMDVLHSKMKPVQAQP-QNDQRKESYEDPD-----
Consensus

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**Figure S15 Multiple sequence alignment of FBP aldolases/phosphatases.** The conserved lysine 232 and tyrosine 348 assumed to participate in the catalytic cycle are highlighted with yellow boxes. The conserved stretch of 5 amino acids mentioned in the text is marked by a box. The alignment was made by using CLUSTAL W implemented within BioEdit software (<http://www.mbio.ncsu.edu/BioEdit/bioedit.html>).

## Supplementary Tables

**Table S11 Distribution of putative aldolase and FBP phosphatase genes among completely sequenced archaeal genomes.** Red columns indicate missing genes, green columns present genes (cut off value = 1E-45). The organisms are grouped and marked by a colour code as in Fig. 2. None of the archaeal genomes contains a classical FBP aldolase of class I or class II and columns were therefore omitted. In contrast all Archaea except very few methanogens and halobacteria possess the FBP aldolase/phosphatase gene (formerly designated archaeal type V FBP phosphatase). Most of the genomes lacking the FBP aldolase/phosphatase gene contain the gene for a classical FBP phosphatase (class I or II; expect values in these cases are partially higher than 1E-45 and therefore marked red/green). Only few Archaea possess an additional FBP phosphatase/inositol monophosphatase belonging to class IV phosphatases. Aldolases are also required in the biosynthesis of aromatic amino acids. Some Archaea use the classical pathway with 3-deoxy-D-arabino heptulosonate 7-phosphate (DAHP) synthase [EC 2.5.1.54] as key enzyme; those are lacking the gene coding for 2-amino-3,7-dideoxy-D-threo-hept-6-ulosonic acid (ADH) synthase, which is the key enzyme of an archaeal pathway<sup>1</sup>. ADH synthase has also low FBP aldolase side activity<sup>2</sup>, which, however, is too low to explain growth. Note that the genes coding for FBP aldolase class IA and ADH synthase are closely related and most BLAST searches result in the same hit for both genes (marked in light blue). Only a few Archaea possess FBP aldolase of class IA that are highly similar to the characterized *Thermococcus kodakarensis* enzyme. It appears that the halobacteria and the methanogens that lack FBP aldolase/phosphatase contain another FBP aldolase, which is only distantly related to these class IA enzymes<sup>3,4</sup> (and therefore require an additional monofunctional FBP phosphatase, see above). The parasitic Archaeon *Nanoarchaeum equitans* does not have a gene for any aldolase or phosphatase and is unable to synthesize any building blocks.

Group	Organism	FBP aldolase/ phosphatase <i>Thermococcus kodakarensis</i>		FBP aldolase class IA <i>Thermococcus kodakarensis</i>		ADH synthase <i>Methanocaldococcus jannaschii</i>		DAHP synthase <i>Pyrococcus furiosus</i>		FBP phosphatase class I <i>Escherichia coli</i>		FBP phosphatase class II <i>Escherichia coli</i>		FBP phosphatase class IV <i>Methanocaldococcus jannaschii</i>		
		Expect value	Accession	Expect value	Accession	Expect value	Accession	Expect value	Accession	Expect value	Accession	Expect value	Accession	Expect value	Accession	
Crenarchaeota	<i>Hyperthermus butylicus</i> DSM 5456	2E-151	A20K38	1E-63	A218L5	7E-23	A20M45	2E-90	A20I87	4E-01	A21P99	9E-01	A20K32	9E-30	A20N76	
	<i>Staphylothermus marinus</i> F1	6E-147	A3DM22	2E-89	A3DPX0	4E-42	A3DPX0	5E-01	A3DL12	1E-02	A3DL25	1E+00	A3DP90	2E-17	A3DL25	
	<i>Thermofilum pendens</i> Hrk5	4E-135	A1RW66	3E-75	A1S0R3	2E-43	A1RYF8	2E-02	A1RY24	1E+00	A1RW00	2E-02	A1RZK1	3E-18	A1RW00	
	<i>Ignicoccus hospitalis</i> KIN41	9E-147	A8A9E4	5E-03	A8A8T8	2E-01	A8A9U2	2E-88	A8ACG0	1E-03	A8A9C4	3E-01	A8A8G2	2E-17	A8A9C4	
	<i>Sulfolobus tokodaii</i> str.7	8E-133	Q975V5	9E-32	Q96Y18	3E-39	Q96Y18	1E-82	Q96Y97	7E-02	Q974W3	4E+00	Q96Z29	5E-23	Q974W3	
	<i>Sulfolobus acidocaldarius</i> DSM 639	1E-131	Q4JAX4	4E-03	Q4JL33	4E-04	Q4JAA6	2E-82	Q4IC77	3E-01	Q4JAF3	2E+00	Q4JF32	1E-23	Q4JAA8	
	<i>Sulfolobus solfataricus</i> P2	4E-131	Q980K6	9E-32	Q97J03	6E-40	Q97J03	6E-81	Q980J0	1E+00	Q97VZ6	9E-02	Q97U17	1E-24	Q97W26	
	<i>Metataphaeus sedula</i> DSM 5348	6E-129	A4VY25	4E-30	A4V0B2	6E-34	A4V0B2	7E-81	A4V1M4	3E-01	A4V1M4	2E-01	A4V1C0	3E-25	A4V1E6	
	<i>Pyrobaculum arsenaticum</i> DSM 13514	8E-131	A4WH89	3E-03	A4WH86	6E-02	A4WLK3	3E-76	A4WMN6	3E-02	A4WL73	1E-01	A4W1E8	2E-11	A4WL73	
	<i>Pyrobaculum caldifortis</i> JCM 11548	1E-130	A3MSD2	7E-04	A3MSN0	5E-02	A3MV24	5E-75	A3MUK0	2E-01	A3MXA8	9E-01	A3MY99	2E-07	A3MUT7	
	<i>Pyrobaculum aerophilum</i> str. JM2	1E-130	Q8ZY51	6E-03	Q8ZU00	2E-01	Q8ZT09	6E-77	Q8ZW76	2E-02	Q8ZV73	2E-02	Q8ZV73	8E-09	Q8ZTW9	
	<i>Pyrobaculum islandicum</i> DSM 4184	6E-130	A1RTR7	8E-03	A1RU66	3E-04	A1RR49	7E-78	A1RV55	9E-02	A1RRP5	4E-01	A1RQ28	2E-11	A1RRP5	
	<i>Thermoproteus neutrophilus</i> V245a	1E-129	B1YAL1	8E-03	B1Y889	3E-04	B1Y8F3	7E-78	B1YD58	7E-02	B1Y8E3	3E-01	B1Y1C7	9E-12	B1YAE3	
	<i>Caldiverga moquilingensis</i> IC-167	2E-129	A8M0X2	3E-43	A8M8E0	9E-43	A8M8E0	5E-88	A8M8V6	3E-01	A8M8Q0	2E-01	A8M1A8	9E-24	A8M8Q0	
	<i>Aeropyrum pernix</i> K1	3E-146	Q9YD03	6E-75	Q9YG90	5E-43	Q9YG90	2E-86	Q9Y1E7	3E-01	Q9YR22	3E-01	Q9Y1C0	4E-17	Q9Y4Z7	
	Euryarchaeota	<i>Pyrococcus abyssi</i> G5	0E+00	Q9U248	5E-148	Q9V216	6E-38	Q9V216	1E-132	Q9V110	3E-01	Q9V126	8E-01	Q9V214	8E-66	Q9V126
		<i>Pyrococcus furiosus</i> DSM 3638	0E+00	Q8U359	2E-152	P58314	2E-38	P58314	3E-147	Q8U0A9	4E-01	Q8T277	7E-01	Q8U1B5	4E-66	Q7W303
		<i>Pyrococcus horikoshii</i> OT3	0E+00	OS8501	1E-150	OS7840	8E-41	OS7840	3E-01	OS9284	8E-01	OS9523	8E-01	OS7790	8E-62	OS9523
		<i>Thermococcus annularius</i> NA1	0E+00	B6YTP6	2E-150	B6YWC8	3E-36	B6YWC8	2E-127	B6YX08	6E-03	B6YX01	4E-01	B6Y1Q1	8E-69	B6YW30
<i>Thermococcus kodakarensis</i> KOD1		0E+00	Q8NKP9	6E-163	Q8J308	3E-39	Q8J308	4E-126	Q8JF90	3E-02	Q8JH93	4E-01	Q8J587	2E-58	Q8JH93	
<i>Thermoplasma volcanium</i> GS1		5E-141	Q978E7	6E-03	Q979Y3	1E+00	Q97AM4	2E-71	Q978P0	6E-02	Q97A11	5E-01	Q97CM1	3E-02	Q97859	
<i>Picrophilus torridus</i> DSM 9790		6E-140	Q6L0W0	1E-01	Q6KZ36	2E-01	Q6L2P2	1E-75	Q6L278	9E-01	Q6L0F7	2E+00	Q6L1N1	2E-02	Q6L1N1	
<i>Thermoplasma acidophilum</i> DSM 1728		2E-139	Q9H1B3	3E-03	Q9HK55	3E-01	Q7A110	3E-69	Q9H1U1	4E-01	Q9H130	2E+00	Q9H137	2E-01	Q9H1V4	
<i>Archaeoglobus fulgidus</i> DSM 4304		8E-163	Q28830	2E-40	Q30128	1E-94	Q30128	1E+00	Q28479	1E+00	Q29233	9E-01	Q28856	9E-32	Q30298	
Korarchaeota		<i>Candidatus 'Korarchaeum cryptofilum'</i> OPF8	4E-138	B1L6Y4	1E-31	B1L310	2E-88	B1L310	1E-01	B1LSU2	2E-02	B1L7E3	3E-03	B1L206	4E-19	B1L7E3
Methanogenic Euryarchaeota	<i>Methanocaldococcus jannaschii</i> DSM 2661	2E-138	Q37747	2E-39	Q37843	1E-157	Q37843	7E-06	Q38465	1E+00	Q38239	6E-03	Q38058	3E-45	Q37573	
	<i>Methanosarcina thermophila</i> PT	1E-164	A0B8T5	9E-39	A0B6T4	1E-98	A0B6T4	7E-01	A0B831	7E-01	A0B7E6	3E-01	A0B7W5	1E-24	A0B7E6	
	<i>Methanopyrus kandleri</i> AV19	4E-147	Q8TWS8	1E-45	Q8TV10	1E-98	Q8TV10	2E-03	Q8TW00	2E-02	Q8TUS9	8E-01	Q8T266	3E-16	Q8TQ03	
	<i>Methanobrevibacter smithii</i> ATCC 35061	3E-144	ASUKU2	4E-41	ASUJ83	2E-100	ASUJ83	2E-01	ASUNX1	4E-01	ASULK6	8E-01	ASUMK2	4E-27	ASULK6	
	<i>Methanothermobacter thermautotrophicus</i> str. Delta H	1E-142	O27721	5E-40	O26679	7E-100	O26679	1E+00	O26359	5E-02	O26359	2E-01	O27345	1E-34	O26957	
	<i>Methanosphaera stadtmanae</i> DSM 3091	4E-138	Q2NGI0	2E-40	Q2NH25	1E-92	Q2NH25	5E-01	Q2NE56	5E-02	Q2NEP7	1E-01	Q2NE22	4E-26	Q2NEP7	
	<i>Methanococcus vannielii</i> SB	8E-132	AGUWJ3	2E-35	AGUSC8	3E-126	AGUSC8	2E-01	AGUJ03	4E-01	AGUNC9	1E-01	AGUW25	6E-33	AGUJ02	
	<i>Methanococcus marisnigri</i> C7	3E-131	AGVWV6	2E-38	AGVZ00	2E-123	AGVZ00	7E-01	AGVG04	4E-01	AGVHA3	9E-02	AGVFC7	5E-38	AGVHT4	
	<i>Methanococcus marisnigri</i> C5	6E-129	A9A6N7	1E-38	A9A799	3E-124	A9A799	5E-01	A9AA11	9E-02	A9A8X5	5E-02	A9A6L4	2E-37	A9A8X5	
	<i>Methanococcus marisnigri</i> JR1	1E-128	A4FZM1	9E-39	A4FYB3	3E-124	A4FYB3	2E-03	A4FX91	3E-01	A4FZT1	1E-02	A4FZB4	4E-37	A4FWS4	
	<i>Methanococcus aeolicus</i> Nankai-3	6E-126	AGUT12	2E-38	AGUT72	6E-122	AGUT72	2E-03	AGUJ04	5E-01	AGUW17	1E-01	AGU1R1	3E-33	AGUWH3	
	<i>Candidatus 'Methanoregella boonei'</i> GA8	2E-118	A789B8	7E-37	A78184	4E-85	A78184	8E-01	A78A83	5E-40	A78B86	4E-01	A78F80	7E-26	A78B86	
	<i>Conarchaeum symbiosum</i> A	3E-78	ADRJ30	2E-30	ADRJ26	1E-66	ADRJ26	5E-02	ADRW57	2E-01	ADRYS3	3E+00	ADRJ72	4E-24	ADRYS3	
	<i>Nitrososphaera marisnigri</i> SCM1	1E-78	A9A3J9	2E-35	A9A236	6E-70	A9A236	6E-05	A9A1R0	1E-01	A9A571	4E+00	A9A3P9	5E-27	A9A336	
	Halophilic Euryarchaeota	<i>Halobacterium salinarum</i> R1	2E-01	Q9H8R3	2E-36	Q9H588	5E-56	Q9H588	9E-02	Q9H5A5	4E-33	Q9H911	4E-02	Q9H9Y3	9E-04	Q9H912
		<i>Natronomonas pharaonis</i> DSM 2160	6E-01	Q3IU14	9E-39	Q3IS18	7E-57	Q3IQC5	1E+00	Q3IRY6	2E-36	Q3IS19	6E-02	Q3IM55	4E-05	Q3INW7
		<i>Halorubrum lacusprofundi</i> ATCC 49239	8E-01	A7D4Z3	2E-35	A7D0X8	9E-62	A7D5Z7	2E-02	A7D548	4E-37	A7D0X9	5E-02	A7D5W9	7E-08	A7D579
		<i>Halorubrum marismortui</i> ATCC 43049	1E+00	Q5V7U6	5E-34	Q5V141	3E-62	Q5V141	3E-01	Q5V692	3E-37	Q5V321	2E-03	Q5V674	2E-14	Q5V1W9
	Methanogenic Euryarchaeota	<i>Haloquadratum walsbyi</i> DSM 16790	5E+00	Q185E9	2E-39	Q182Y5	2E-59	Q182Y5	5E+00	Q182Y9	7E-29	Q181E3	2E-02	Q181E3	3E-17	Q185E9
Methanogenic Euryarchaeota	<i>Candidatus 'Methanosphaerula palustris'</i> E1-9c	1E-37	B6Y9R8	1E-34	B6Y9E1	5E-82	B6Y9Z2	3E-01	B6YF44	7E-44	B6Y6Y7	4E-01	B6Y8T0	1E-26	B6Y6Y5	
	<i>Methanocorpusculum labreanum</i> Z	9E-06	A25T38	8E-33	A25U09	6E-89	A25U09	4E-01	A25T91	6E-46	A25T39	7E-02	A25U08	1E-28	A25Q77	
	<i>Methanospirillum hungatei</i> JF-1	1E-02	Q2FR28	1E-33	Q2FQ50	2E-83	Q2FQ49	3E-01	Q2FQ63	3E-45	Q2FM20	1E+00	Q2FPW5	1E-27	Q2FQ94	
	<i>Methanosarcina acetivorans</i> CZA	5E-01	Q8TKB8	5E-39	Q8TJ12	6E-100	Q8THC6	8E-01	Q8TPM1	6E-02	Q8TKQ4	5E-60	Q8TRM3	3E-32	Q8TKQ4	
	<i>Methanosarcina barkeri</i> str. fusaro	5E-01	Q46E66	3E-41	Q46E61	6E-101	Q46D29	2E-01	Q466R1	5E-02	Q46AH4	5E-99	Q46E65	3E-34	Q46AH4	
	<i>Methanococcus burtoni</i> DSM 6242	7E-01	Q12WA3	6E-39	Q12U16	8E-104	Q12U16	2E-02	Q12VW6	6E-01	Q12XW3	4E-56	Q12W44	1E-33	Q12XW3	
	<i>Methanosarcina mazei</i> Go1	2E+00	Q8Q0S8	7E-38	Q8PW62	4E-101	Q8PVE9	1E+00	Q8PY62	6E-02	Q8PTD2	2E-58	Q8PU27	2E-33	Q8PTD2	
	<i>uncultured methanogenic archaeon</i> RC-1	8E-01	Q0W3C1	2E-38	Q0W650	1E-94	Q0W130	2E-01	Q0W4D3	8E-03	Q0W1B8	1E-01	Q0W4U0	2E-15	Q0W1B8	

**Table S12 Purification of recombinant FBP aldolase/phosphatase of *Ignicoccus hospitalis* from *E. coli* cells.** 1 U = 1  $\mu\text{mol min}^{-1}$ .

Step	Total protein / [mg]	Phosphatase activity				Aldolase activity			
		Activity / [U]	Specific activity / [U/mg]	Yield / [%]	Purification [-fold]	Activity / [U]	Specific activity / [U/mg]	Yield / [%]	Purification [-fold]
Heat-precipitation	13.3	3.2	0.24	100	1.0	1.8	0.14	100	1.0
Gel filtration	3.7	1.5	0.41	46	1.7	1.2	0.31	63	2.3
MonoQ	1.6	1.1	0.70	34	2.9	0.9	0.55	47	4.0



**Table S13** PCR primers and conditions used for amplification of the FBP aldolase/phosphatase gene from different organisms. The restriction sites introduced by the primers are underlined.

Organism	Gene ID and synonym	Forward primer	Reverse Primer	Restriction sites	Annealing temp. / [°C]	Elongation time	Expression vector	Affinity tag	Plasmid name
<i>Ignicoccus hospitalis</i>	<a href="#">5563123</a> <a href="#">Igni_0363</a>	AGATATAC- <u>CATATG</u> CCCCCTAGTGGC CCAG	GCAGA <u>AAGCTT</u> GTGGA- TAAGGGTAG	<i>NdeI/HindIII</i>	60	2 min 35 sec	pT7-7	-	FBP_I.hosp- X-pT7-7
<i>Ignicoccus hospitalis</i>	<a href="#">5563123</a> <a href="#">Igni_0363</a>	AGATATAC- <u>CATATG</u> CCCCCTAGTGGC CCAG	GCAGA <u>AAGCTT</u> GTGGA- TAAGGGTAG	<i>NdeI/HindIII</i>	60	2 min 35 sec	pET16b (Novagen)	His <sub>10</sub> N-terminal	FBP_I.hosp- X-pET16b
<i>Sulfolobus tokodaii</i>	<a href="#">1458230</a> <a href="#">ST0318</a>	GCGCCGCGGGG <u>CATAT-</u> GATGAAAACTACTA- TAAG	GCGGGCGGGG <u>GCTCTA</u> GATAAAATTAAGATAAAAG	<i>NdeI/XbaI</i>	40	4 min 55 sec	pT7-7	-	FBP_S.tok- X-pT7-7
<i>Metallosphaera sedula</i>	<a href="#">5104211</a> <a href="#">Msed_2259</a>	GCCGCGGGC <u>CATATGA-</u> GATCTACTGTTAGTG	CGGCC <u>CAAGCTT</u> GTGTT ATCGTCGAG	<i>NdeI/HindIII</i>	50	4 min 50 sec	pT7-7	-	FBP_M.sed- X-pT7-7
<i>Thermoproteus neutrophilus</i>	<a href="#">6164372</a> <a href="#">Tneu_0133</a>	AACC- TATCC <u>CATATG</u> CGGGTT ACGGTTTCC	CCCTGGGAAAC <u>CTCTA-</u> GACTCCTCCGACCTCAC	<i>NdeI/XbaI</i>	55	5 min	pT7-7	-	FBP_T.neut- X-pT7-7
<i>Thermoproteus neutrophilus</i>	<a href="#">6164372</a> <a href="#">Tneu_0133</a>	AACC- TATCC <u>CATATG</u> CGGGTT ACGGTTTCC	CCCTGGGAAAC <u>CTCTA-</u> GACTCCTCCGACCTCAC	<i>NdeI/XbaI</i>	55	5 min	pET16b (Novagen)	His <sub>10</sub> N-terminal	FBP_T.neut- X-pET16b
<i>Thermoproteus neutrophilus</i>	<a href="#">6164372</a> <a href="#">Tneu_0133</a>	CTGAGAGTGCAC- <u>CATATG</u> CGGGTTACGGT TTCC	ACGCGCCACAT <u>C-</u> <u>TCGAGGTC</u> GTGTTGA- GAC	<i>NdeI/XhoI</i>	55	4 min 55 sec	pET23b (Novagen)	His <sub>6</sub> C-terminal	FBP_T.neut- X-pET23b
<i>Thermococcus kadakarensis</i>	<a href="#">3235025</a> <a href="#">TK2164</a>	CCGGTGGTT <u>CATATGGC</u> CGTTGGAGATAAG	GAACA- <u>GAAGCTT</u> GTGGAAT- CACTCGA- TAGGCTCGAACC	<i>NdeI/HindIII</i>	60	4 min 40 sec	pT7-7	-	FBP_T.kod- X-pT7-7
<i>Methanothermobacter marburgensis</i>	RMMA00378 chromo- some_326124 _325027	GGGCGGCTGGAGGTGT <u>ACATATG</u> AAAAACAAC- CATTAGTG	CGCGGTGTGGGTGGA <u>AG</u> <u>CTTCTTTAATC-</u> CATGTCCTC	<i>NdeI/HindIII</i>	60	4 min 40 sec	pT7-7	-	FBP_M.mar- X-pT7-7
<i>Moorella thermoacetica</i>	<a href="#">3831377</a> <a href="#">Moth_2266</a>	GGGCAAG- GAGGCTGTGCT <u>CATATG</u> GGTAAAAGGATTAC	AGCGGAAT <u>TCCGCCTA</u> TTTGGCTCCC	<i>NdeI/EcoRI</i>	60	4 min 40 sec	pT7-7	-	FBP_M.thac- X-pT7-7
<i>Thermus thermophilus</i>	<a href="#">2776039</a> <a href="#">TTC0616</a>	AGGAGGTGAG <u>CATAT-</u> <u>G</u> AAGGTACACCTTGAG	AAAGTGAA- <u>GAAGCTT</u> GACCCGGGAG CC	<i>NdeI/HindIII</i>	55	4 min 40 sec	pT7-7	-	FBP_T.ther- m-X-pT7-7

- 1 Grochowski, L. L. & White, R. H. Promiscuous anaerobes: new and unconventional metabolism in methanogenic archaea. *Ann N Y Acad Sci* **1125**, 190-214 (2008).
- 2 Samland, A. K., Wang, M. & Sprenger, G. A. MJ0400 from *Methanocaldococcus jannaschii* exhibits fructose-1,6-bisphosphate aldolase activity. *FEMS Microbiol Lett* **281**, 36-41 (2008).
- 3 Altekar, W. & Dhar, N. M. Archaeobacterial class I and class II aldolases from extreme halophiles. *Orig Life Evol Biosph* **18**, 59-64 (1988).
- 4 Krishnan, G. & Altekar, W. An unusual class I (Schiff base) fructose-1,6-bisphosphate aldolase from the halophilic archaeobacterium *Haloarcula vallismortis*. *Eur J Biochem* **195**, 343-350 (1991).