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SUPPLEMENTARY INFORMATION

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Integrated records of environmental change and evolution challenge the Cambrian Explosion

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Supplementary Information

Details for Figure 1:

$\delta^{13}C_{carb}$ data

Late Cambrian C isotopes of the Kyrshabakty River, Kazakhstan, from Saltzman et al. (2000)

Late Cambrian C isotope profile of Green Point Formation (Cambrian-Ordovician GSSP, Cow Head Group, Western Newfoundland) from unpublished data of Ripperdan presented in Azmy et al. (2014)

C isotope profile compiled from Ravensthroat-Sheepbed-Sheepbed carbonate-June Beds-Gametrail-Blueflower-Risky formations from Macdonald et al. (2013)

C isotope profile of upper Cambrian SPICE event at Shingle Pass (Nevada) across Emigrant Springs-Johns Wash-Corset Spring-Whipple Cave formations from Saltzman et al. (1998)

Composite C isotope profile of Doushantuo-Qinshudong formations after data in Zhou et al. (2012) (Doushantuo Fm., Jiulongwan section), Wang et al. (2016) (Doushantuo-Liuchapo Fms., Siduping section), Tahata et al. (2013) (Nantuo-Dengying Fms.), Ishikawa et al. (2008) (Dengying-Yanjiahe-Shuijingtuo-Shipai Fms., Three Gorges), Ishikawa et al. (2014) (Shipai Fm., Three Gorges, Drill core 6), Chang et al. (2017) (Dengying-Mufushan-Paotaishan Fms., K2 well; Hetang-Dachenling-Yangliugang Fms., WN2 well), Zhu et al. (2004) (Huaqiao-Aoxi-Qingshudong Fms., Wangcun)

C isotope profile for Rasthof-Gruis-Ombaatjie-Karibib formations of the Abenab Subgroup, Otavi Group, Namibia, from Halverson et al. (2005). The underlying Chuos Formation is a diamictite thought to be of Sturtian age, and the base of the Chuos Formation is defined by an erosional unconformity (Hoffmann et al., 2004; Halverson et al., 2005). The C isotope profile for the Abenab Subgroup has been condensed relative to that represented in Macdonald et al. (2010) in order to conform to the potential extent of the Sturtian glacial represented by the upper age of the Wilverpa Formation diamictite (Fanning and Link, 2008).

C isotope profile for Kuibis and Schwarzrand subgroups of the Nama Group, Namibia, is from Kaufman et al. (1991) (Buschmannsklippe-Schwarzrand subgroups), Smith (1998, unpublished Master's thesis) (Driedoornvlakte reef, Upper Omkyk Member, Zaris Formation, Kuibis Subgroup) and Wood et al. (2015) (Kuibis and Schwarzrand subgroups)

C isotope profile of Hadash, Masirah Bay, Kufai, Shuram, and Buah formations from Fike et al. (2006). C isotope profile for Ara Group from Amthor et al. (2003)

C isotope profile for Nuccaleena, Bunyeroo, and Wonoka formations from Calver (2000). Additional C isotope data for Wonoka Formation from Husson et al. (2015). Composite C isotope profile for middle Cambrian including Parachilna-Woodendina-Wilkawillina-Andamooka-Ouldburra-Kulpara formations across 4 sections from Hall (2012, unpublished PhD thesis).

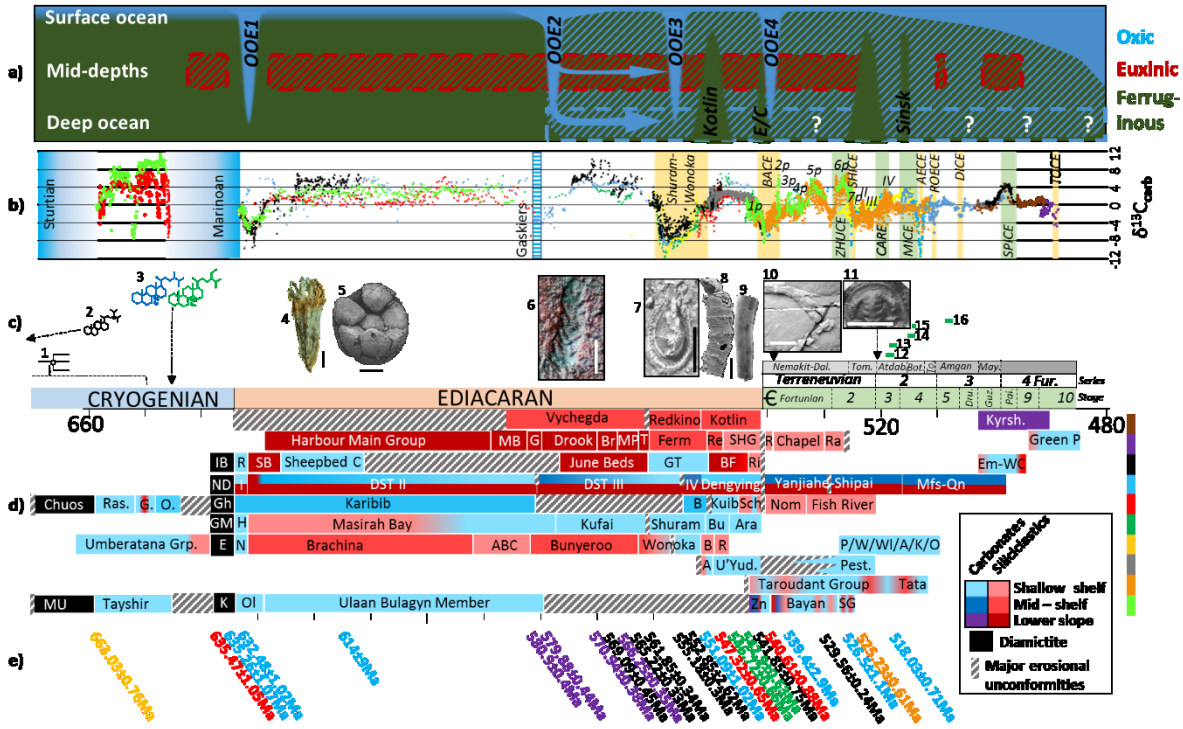
C isotope profile of Aim and Ust' Yudoma formations, Kyry-Ytyga section, Yudoma River from Zhu et al. (2017)

Composite C isotope profile from Anti-Atlas Mountains, Morocco (Maloof et al., 2005). Adoudou and Lie de Vin formations of the Taroudant Group and Igoudine, Amouslek and Issafene formations of the Tata Group. Composite measured sections MS3-12 of Maloof et

al. (2005): 3 (Talat N'Yisi), 4 (Tagrara), 6 (Tiout, data from Tucker, 1986 and Magaritz et al., 1991), 7 (Oued Sdas), 8 (Oued N'Oulili), 10 (Adrar Minount), 11 (North Bougzoul) and 12 (South Bougzoul)

Composite C isotope profile from the Zavkhan terrane, SW Mongolia. Carbon isotopes from the Cryogenian to Ediacaran Tsagaan Oloom Formation from Macdonald et al. (2009). Carbon isotope data from Bayan Gorge and Orolgo Gorge sections (Zuun-Arts to Salaany Gol (/Salaagol) formations) from Smith et al. (2016)

Cambrian C isotope peaks 1p-7p and II-IV follow Kouchinsky et al. (2007) and Maloof et al. (2010)



Supplementary Figure 1: Stratigraphic coverage and U-Pb age constraints.

Subgroup/Formation /Member abbreviations

Colour coding dominant stratigraphy: Black, glacial diamictite; Blue, carbonates (dark – light: deep to shallow); Red, siliciclastics (dark – light: deep to shallow). Darkest: lower slope, mid: mid – shelf, lightest: shallow shelf. It should be acknowledged that this lithological key oversimplifies individual areas which represent the full shelf – basin transect (e.g. Yangtze Block, where deep water equivalents to the Doushantuo – Dengying formations include the Lantian and Liuchapo/Piyuancun formations)

Dark Brown:
East European Platform (Baltica)
Correlation of Vychegda – Kotlin formations is based on conservative estimates of Johnston et al. (2012) after consideration of Ediacaran Complex Acanthomorph – dominated Palynoflora distribution elsewhere

Kyrsh.: Kyrshabakty River Section (Kazakhstan)

Purple:
West Avalonia (eastern Newfoundland)
MB: Mall Bay Formation, G: Gaskiers Formation, Br: Briscal Formation, MP: Mistaken Point Formation, T: Trepassey Formation, Ferm: Fermeuse Formation, Re: Renews Head Formation, SHG: Signal Hill Group, R: Rencontre, Chapel: Chapel Island, Ra: Random, Green P: Green Point Formation.

Black:
Laurentia (NW Canada)
IB: Ice Brook Formation, R: Ravensthroat Formation, SB: Sheepbed Formation, Sheepbed C: Sheepbed Carbonate unit, GT: Gametrail Formation, BF: Blueflower Formation, Ri: Risky Formation, Em – WC: Emigrant Springs-Whipple Cave formations.

Light Blue:
Yangtze Block (South China)
ND: Nantuo Diamictite, I: Doushantuo Formation, Member 1, DST II: Doushantuo Formation, Member 2, DST III: Doushantuo Formation, Member 3, IV: Doushantuo Formation, Member 4, Mfs – Qn: Mufushan to Qingshudong formations (Note that this correlation does not reflect formation subdivision within a single section, but rather relative ages of formations across different sections).

Red:
Combined Congo and Kalahari Cratons (Namibia)
Ras.: Rasthof Formation, G.: Gruis Formation, O.: Ombaatjie Formation (Ras. – O., together with underlying Chuos Sturtian glacial diamictite, comprise the Abenab Subgroup), Gh: Ghaub Marinoan glacial diamictite, B: Buschmannsklippe Formation, Kuib: Kuibis Subgroup, Sch: Schwarzrand Subgroup.

Green:
Arabian-Nubian Shield (Oman)
GM: Ghadir Manqil Marinoan glacial diamictite, H: Hadash cap carbonate, Bu: Buah Formation, Ara: Ara Group.

Yellow:
South Australia
E: Elatina Formation, N: Nuccaleena Formation, ABC: ABC Range Formation, B: Bonney Sandstone, R: Rawnsley Quartzite, P: Parachilna Formation, W: Woodendinna Dolomite, Wl: Wilkawillina Formation, A: Andamooka Limestone Formation, K: Kulpara Formation, O: Ouldburra Formation.

Grey:
Yudoma-Maya depression (southeast Siberian Platform)
A: Aim Formation, U'Yud.: Ust' Yudoma Formation, Pest.: Pestrotsvet Formation.

Gold:
Composite C isotope profile from Anti-Atlas Mountains, Morocco (Maloof et al., 2005). Adoudou and Lie de Vin formations of the Taroudant Group and Igoudine, Amouslek and Issafene formations of the Tata Group.

Bright Green:
Composite C isotope profile from the Zavkhan terrane, SW Mongolia (Macdonald et al., 2009; Smith et al., 2016). Members of the Tsagaan Oloom Formation, MU: Malkhan Ul

Member, K: Khongoryn Member diamictite, Ol: Ol Member. Zn: Zuun-Arts Formation, Bayan: Bayangol Formation, SG: Salaany Gol (/Salaangol) Formation.

U-Pb ages

663.03 +/- 0.76 Ma: ^{206}Pb-^{238}U zircon CA-ID-TIMS age from sixteen single grain analyses (MSWD=0.52). Age given includes propogation of tracer calibration and ^{238}U decay constant uncertainties. Within uppermost Sturtian diamictites (Wilyerpa Formation) of the Umberatana Group (stratigraphically above the Burra Group and below the Wilpena Group) west of Copley township (Cox et al., 2018).

635.47 +/- 1.05 Ma: U-Pb age from six concordant single grain analyses. Ash bed within glacial deposits of the Ghaub Formation (Hoffmann et al., 2004; Schmitz, 2012)

635.26 +/- 1.07 Ma: zircon U-Pb CA-ID-TIMS age from 3 concordant (of 18) single grain analyses. Top of Nantuo diamictite (min. age) (Condon et al., 2005)

632.48 +/- 1.02 Ma: zircon U-Pb CA-ID-TIMS age from 3 concordant (of 9) single grain analyses. Top of Nantuo diamictite (min. age) (Condon et al., 2005)

614 +/- 9 Ma: SHRIMP zircon U-Pb age. Weighted mean of 18 single grains (Liu et al., 2009)

580.9 +/- 0.4 Ma: zircon U-Pb CA-ID-TIMS age of Upper Mall Bay Formation. Nine single grain analyses (Pu et al., 2016)

579.88 +/- 0.4 Ma: zircon U-Pb CA-ID-TIMS age of lower Drook Formation. Five single grain analyses (Pu et al., 2016)

570.94 +/- 0.38 Ma: zircon U-Pb CA-ID-TIMS age of upper Drook Formation. Five single grain analyses (Pu et al., 2016)

569.09 +/- 0.45 Ma: zircon U-Pb CA-ID-TIMS age from 2 concordant (of 12) single grain analyses. Bennscliffe Breccia between Blackbrook Reservoir Formation and Beacon Hill Formation (Charnian Supergroup). Noble et al. (2015)

566.25 +/- 0.35 Ma: zircon U-Pb CA-ID-TIMS age of Mistaken Point Formation. Five single grain analyses (Pu et al., 2016)

565.22 +/- 0.33 Ma: zircon U-Pb CA-ID-TIMS age from 2 concordant (of 5) single grain analyses. Beacon Hill Formation (Maplewell Group, Charnian Supergroup). Noble et al. (2015).

561.85 +/- 0.34Ma zircon U-Pb CA-ID-TIMS age from 7 concordant (of 12) single grain analyses. Bradgate Formation (Maplewell Group, Charnian Supergroup). Noble et al. (2015).

556.6 +/- 6.4Ma (not noted due to space) zircon U-Pb CA-ID-TIMS age from 4 single grain analyses. Hanging Rocks Formation (Maplewell Group, Charnian Supergroup). Noble et al. (2015).

555.18 +/- 0.3 Ma: zircon U-Pb CA-ID-TIMS age from 8 (of 8) concordant single grain analyses. Ash bed in upper Bocaina Formation. (Parry et al., 2017)

552.85 +/- 2.62 Ma: Weighted mean zircon $^{207}Pb/^{206}Pb$ age for Zimnie Gory section. Uppermost Ust-Pinega Formation, near base of sequence B. Nineteen single grain and small multigrain fractions (Martin et al., 2000; recalculated in Schmitz, 2012)

551.09 +/- 1.02 Ma: Weighted mean zircon $^{206}Pb/^{238}U$ CA-ID-TIMS age from 2 concordant (of 10) single grain analyses. Ash bed in upper Doushantuo member IV at Jiuqunao. Condon et al. (2005).

547.32 +/- 0.65 Ma: zircon U-Pb CA-ID-TIMS age from 8 single grain analyses. Lower Hoogland Member, Zaris Formation, Kuibis Subgroup, Nama Group, Namibia (Bowring et al., 2007).

546.72 +/- 0.66 Ma: zircon U-Pb CA-ID-TIMS age from 8 single grain analyses. Ara Group, middle of A0 carbonate unit (Bowring et al., 2007).

545.76 +/- 0.66 Ma: zircon U-Pb CA-ID-TIMS age from 5 single grain analyses. Lower Liuchapo Formation, deep slope Longbizui section, Hunan, South China. Not noted due to space constraint (Yang et al., 2017).

542.9 +/- 0.63 Ma: zircon U-Pb CA-ID-TIMS age from 8 single grain analyses. Ara Group, 3m above base of A3 carbonate unit. (Bowring et al., 2007)

541.85 +/- 0.75 Ma: zircon U-Pb CA-ID-TIMS age from 5 concordant single grain analyses. Volcanic tuff from Upper Tamengo Formation (Parry et al., 2017)

540.61 +/- 0.88 Ma: zircon U-Pb air abrasion ID-TIMS age from ten multigrain zircon fractions. Silicified volcanic tuff deposit in upper Spitskop Member, Urusis Formation, Schwarzrand Subgroup, Nama Group, Namibia (Grotzinger et al., 1995, Schmitz, 2012).

539.4 +/- 2.9 Ma: U-Pb SHRIMP age of bentonites. Meishucun section, bed 5 (Zhongyicun Member of the Zhujiaqing Formation) (Compston et al., 2008).

529.56 +/- 0.24Ma: zircon U-Pb TIMS age. Volcanic tuff of the Mattaia Formation (Kessyusa Group). Kaufman et al. (unpublished, 2012). Section in the Olenek uplift, near confluence of Khorbusuonka and Mattaia rivers (information in Nagovitsin et al., 2015).

526.5 +/- 1.1 Ma: U-Pb SHRIMP age of bentonites. Meishucun section, bed 9 (base of Shiyantou Formation) (Compston et al., 2008)

525.23 +/- 0.61Ma. U-Pb zircon age. CA-ID-TIMS from eight single grain analyses. Ash bed at level of major positive C isotope excursion at Nemakit-Daldynian/Tommotian boundary. Upper Adoudou Formation, Morocco. Maloof et al. (2005); Schmitz (2012)

518.03 +/- 0.71 Ma: Youngest zircon U-Pb CA-ID-TIMS age (incorporating U-Pb tracer calibration uncertainty) from five single grain analyses of detrital zircons from the Maotianshan shale immediately underlying Chengjiang biota. Taken as maximum depositional age for the Chengjiang biota. (Yang et al., 2018)

Redox schematic

Palaeoredox information assimilated from the following publications (and references therein):

Bowyer et al. (2017); Canfield et al. (2008); Spangenberg et al. (2014); Sperling et al. (2015); Gill et al. (2011); Hood and Wallace (2015); Wallace et al. (2015)

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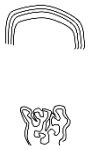
Figures 3 and 4. Fossil key and occurrence catalogue (not exhaustive):

Ichnofossils					
Symbol	ID	Notable occurrences	Stratigraphic Position	E.g. References	Notes
	*Archaeichnium*	Namibia: Witputs subbasin, Farms Arimas and Groendorn. Zaris subbasin, Farm Harughas. Australia.	Lower Huns Member. Nasep Member. Rawnsley Quartzite.	Glaessner (1963, 1978); Germs (1972a); Jensen et al. (2000); Noffke et al. (2002); Gehling and Droser (2013)	Possible body fossil (Acenolaza et al., 2009)
	*Bergaueria*	Witputs subbasin, Farm Kuibis	Urikos Member	Crimes and Germs (1982)	May be *Intrites* in Nama Group (Crimes, 1989). May represent MISS (Menon et al., 2016)
	*Brooksella*	Witputs subbasin, Farm Huns. Zaris subbasin.	Nasep Member. Urusis Formation.	Crimes and Germs (1982)	Possible body fossil after Jensen et al. (2006). Possible sponge (Ciampaglio et al., 2006)
	*Buchholzbrunnichnus kroeneri*	Witputs subbasin, Farm Buchholzbrunn	Kliphoek Member	Germs (1973b)	Reinterpreted as body fossil of unknown affinity (Jensen and Runnegar, 2005)
	Possible *Chondrites*	Zaris subbasin, Farm Kuderup	Vingerbreek Member	Crimes and Germs (1982)	Uncertain affinity. Possibly *Archaeonassa* (Jensen and Runnegar, 2005)
	Cochlichnus	Witputs subbasin, Farm Arimas	Lower Huns Member	Jensen and Runnegar (2005)	
	Complex backfilled burrows	Zaris subbasin, Hauchabfontein Farm	Upper Omkyk Member	Macdonald et al. (2014)	Similar to *Zoophycos* (but see Buatois and Mangano, 2016). Possible Palaeopasichnid (A. Yu. Zhuravlev, pers. com.)
	*Conichnus*	Zaris subbasin, Road transect (D850 and D855), Witputs subbasin, Farm Arimas	Vingerbreek Member, Huns Member	Darroch et al. (2016); Jensen and Runnegar (2005)	
	*Diplichnites*	Witputs subbasin, Farm Vergelee	Nomtsas Formation	Crimes and Germs (1982)	
	*Diplocraterion*	Zaris subbasin, Farm Haruchas, Farm Berghoek, Farm Kuderup	Niederhagen and Vingerbreek Members	Crimes and Germs (1982); Germs (1995)	Possibly more simple than *Diplocraterion* (Grant, 1990; Jensen and Runnegar, 2005)
	*Helminthoidichnites*	South Australia. South China	Rawnsley Quartzite, Dengying Formation, Gaojiashan and Shibantan Members.	Gehling and Droser (2013). Weber et al. (2007)	
	Helminthopsis	Witputs subbasin,	Lower Huns	Jensen and	

		Farm Arimas	Member	Runnegar (2005)	

	*Lamonte trevallis*	South China, Hubei, Yangtze Gorges, Wuhe section	Dengying Formation, Shibantan Member	Meyer et al. (2014)	
	*Multina minima*	Brazil, Corumba Group.	Tamengo and Guaicurus Formations	Parry et al. (2017)	
	*Neonereites*	Witputs subbasin, Farm Vergelee	Nomtsas Formation	Crimes and Germs (1982)	Two proposed ichnospecies: *uniserialis* and *biseriali*. However, reinterpreted as either *Archaeonassa* (Jensen, 2003; Jensen and Runnegar, 2005) or possible body fossil of unknown affinity (Jensen et al., 2006).
	*Nereites*	Zaris subbasin, Farm Haruchas	Vingerbreek Member	Crimes and Germs (1982)	Reinterpreted as possible body fossil of unknown affinity (Jensen et al., 2006).
	*Olenichnus*	Witputs subbasin, Farm Holoog	Huns Member	Jensen and Runnegar (2005)	
	*Palaeophycus*	South China, Hubei, Sandouping Quarry	Dengying Formation, Shibantan Member	Weber et al. (2007)	
	*Parasanmichnites pretzeliformis*	Nama Group, Witputs subbasin, 1.2 km ESE of Koelkrans camp, Fish River Canyon	Lower Spitskop Member	Buatois et al. (2018)	
	*Planolites*	Nama Group: Zaris subbasin. South China: Hubei, Sandouping	Niederhagen Member. Dengying Formation,	Germs (1995); Weber et al. (2007)	

		Quarry.	Shibantan Member		
	Possible *Skolithos*	Zaris subbasin, Farm Grootplaas. Witputs subbasin, Farm Geinochas	Kliphoek Member. Urusis Formation	Crimes and Germs (1982); Pickford (1995)	Uncertain affinity in Kliphoek Member. Nama Group examples reinterpreted as probable body fossil (Crimes and Fedonkin, 1996)
	*Streptichnus narbonnei*	Witputs subbasin, Farm Swartpunt	Spitskop Member (medium scale seq 18 of Saylor, 2003)	Jensen and Runnegar (2005)	

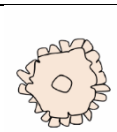
	*Taenidium*	Witputs subbasin, Farm Arimas, Farm Sonntagsbrunn	Nasep Member, Feldschuh-horn Member	Germs (1972a)	
	*Treptichnus isp.*	Witputs subbasin, Farm Arimas	Huns Member	Jensen et al. (2000)	
	*Treptichnus pedum*	Witputs subbasin, Farm Sonntagsbrunn	Nomtsas Formation (VF2 of Wilson et al., 2012)	Germs (1972a); Grotzinger et al. (1995); Geyer and Uchman (1995); Wilson et al. (2012)	
	Unnamed trace fossil	Newfoundland, Mistaken Point.	Mistaken Point Formation	Liu et al. (2010)	
	*Beltanelliformis*	Witputs subbasin, Farm Grens, Farm Aar	Kliphoek Member	Jensen et al. (2000); Vickers-Rich et al. (2013); Wood et al., (2015)	*Nemiana* and *Hagenetta* synonymised with *Beltanelliformis (Grant, 1990;* Ivantsov et al., 2014)
	Stromatolites and thrombolites	Zaris subbasin, Farms Zebra River, Donkergange, and Driedoornvlakte Witputs subbasin, Farm Swartkloofberg	Lower Spitskop Member, Huns Member, Omkyk Member, Mooifontein Member	Germs (1972a; 1995); Grotzinger et al. (2000)	
	Microbially induced sedimentary structures (MISS)	Nambia: Zaris subbasin, (D850), Farm Haruchas, Farm Bullsport. Witputs subbasin, Farm Aar. South China: Hubei, Wuhe section.	Niederhagen Member, Vingerbreek Member, Kliphoek Member. Dengying Formation, Shibantan Member.	Noffke et al. (2002); Bouougri and Porada (2007); Darroch et al. (2016); Vickers-Rich et al. (2013). Meyer et al. (2014)	e.g. Biolaminites in siliciclastic deposits, inferred microbial textures in shallow water limestones

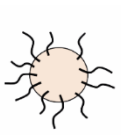
	*Torrowangea*	Purported occurrence in Nama Group. South China, Hubei, Yangtze Gorges	Nasep Member, Urusis Formation, Schwarzrand Subgroup. Dengying Formation, Shibantan Member	Geyer and Uchman (1995); Weber et al. (2007)	
	*Vendotaenia antiqua*	Nama Group. Farm Nutupsdrift, borehole. Witputs subbasin, Tses Borehole and Farms Kliphoek and Sonntagsbrunn. South China, Hubei, Shaanxi.	Vingerbreek and Feldschuhhorn Members. Dengying Formation.	Germs et al. (1986); Cohen et al. (2009); Wilson et al., (2012). Sun (1986); Zhao et al. (1988); Weber et al. (2007)	Below FWWB in the Nama.
	Possible cyanobacterial representatives including *Bavlinella faveolata*	Zaris subbasin, Nutupsdrift borehole. Witputs subbasin, Tses borehole	Urusis Formation (Witputs). Vingerbreek Member (both subbasins). Kuibis Subgroup (Witputs)	Germs et al. (1986)	Possible cyanobacterial sheaths, *Chuaria circularis* and *Bavlinella faveolata* (Mansuy and Vidal, 1983)

Body Fossils					
Soft-bodied					
Symbol	**ID**	**Notable occurrences**	**Stratigraphic Position**	**References**	**Notes**
	*Aspidella*, *Paramedusium*, *Cyclomedusa*	Nama Group, Zaris subbasin, Road transect (D850 and D855). Witputs subbasin, Farm Groendorn (Grondorner). Yudoma Group, Yudoma-Maya confluence.	Vingerbreek Member. Huns Member. Nasep Member. Kliphoek Member. Aim Formation.	Darroch et al. (2016); Germs (1972a); Jensen et al. (2000); Pickford (1995). Zhu et al. (2017)	Junior synonyms of *Aspidella* after Gehling et al. (2000)
	*Ausia fenestrata*	Namibia, Witputs subbasin, Farm Plateau. Russia, White Sea Area.	Kliphoek Member, Verkhovka and Lower Yorga Formations	Hahn and Pflug (1985); Pickford (1995); Grazhdankin (2004)	Possible tunicate?
	*Avalofractus abaculus*	Newfoundland, Avalon Peninsula, Spaniard's Bay	Trepassey Formation	Narbonne et al. (2009)	
	*Beothukis*	Newfoundland, Avalon Peninsula, Mistaken Point. Bonavista Peninsula, Burnt Point.	Mistaken Point 'E' surface, MUN surface	Brasier and Antcliffe (2009); Laflamme et al. (2012); Liu et al. (2016)	*Culmofrons plumosa* synonymised with species *Beothukis plumosa* in Liu et al. (2016)
	*Bradgatia*	Newfoundland, Avalon Peninsula. England, Charnwood Forest.	Mistaken Point. Mercian assemblage, Bed B, North Quarry.	Boynton and Ford (1996); Flude and Narbonne (2008); Wilby et al. (2011)	

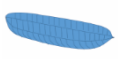
	*Charnia*	Newfoundland, Bonavista Peninsula, Avalon Peninsula. England, Charnwood Forest.	Mistaken Point, Drook – Fermeuse Formations. Mercian assemblage.	Ford (1958); Wilby et al. (2011); Liu et al. (2012, 2015)	
	*Charniodiscus*	Newfoundland and Charnwood Forest. Australia. South China, 3 Gorges area	Drook – Fermeuse Formations. Mercian assemblage. Rawnsley Quartzite. Shibantan Member	Ford (1958); Glaessner and Daily (1959); Glaessner and Wade (1966); Laflamme et al. (2004); Chen et al. (2014)	
	*Conotubus*	South China (Southern Shaanxi)	Gaojiashan Lagerstatte	Zhang (1986); Lin et al. (1986); Cai et al. (2011)	

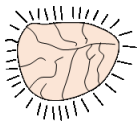
	*Coronacollina*	Australia	Ediacara Member, Rawnsley Quartzite	Clites et al. (2012); Gehling and Droser (2013)	Multi-element, partially skeletonised?
	*Corumbella*	Brazil, Corumbá Group. California, Wood Canyon. Paraguay.	Tamengo Formation. Wood Canyon Formation. Itapucumi Group.	Hahn (1982); Hagadorn and Waggoner (2000); Warren et al. (2012)	
	*Curviacus* (palaeo-pasichnid)	South China, Hubei, Muzhuxia section	Dengying Formation, Shibantan Member	Shen et al. (2017)	
	Dickinsoniomorph	Australia. White Sea	Ediacara Member, Rawnsley Quartzite. White Sea (Vendian Group)	Sprigg (1947); Grazhdankin (2004)	
	*Eoandromeda*	South China, Wenghui (Guizhou). Australia.	Doushantuo Member IV (Miaohe Member). Rawnsley Quartzite.	Tang et al. (2008); Zhu et al. (2008)	
	Eoporpita	Flinders Ranges, Ediacara Range and Brachina Gorge	Rawnsley Quartzite, Ediacara Member	Wade (1972); Seilacher (2003)	Proposed hydrozoan, xeno-phyophoran or holdfast

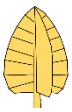
					
	*Ernietta*	Witputs subbasin, Farm Plateau, Farm Aar, Farm Wegkruip, Farm Hansburg	Upper Kliphoek (Aar) Member, Kanies Member	Pflug (1966); Dzik (1999); Bouougri et al. (2011); Elliott et al. (2016)	
	*Fractofusus*	Newfoundland.	Briscal – Fermeuse Formations	Gehling et al. (2007)	
	*Gaojiashania*	Namibia, Zaris subbasin, Farm Donkergange. South China, Shaanxi, Gaojiashan Section. Eastern Siberia, Yudoma – Maya depression.	Hoogland Member. Gaojiashan Member. Aim Formation.	Smith et al. (2017). Hua et al. (2007); Cai et al. (2014); Zhuravlev et al. (2009)	Note reinterpretation as possible *Shaanxilithes* for specimens of Eastern Siberia after Zhu et al. (2017)

	*Haootia*	Newfoundland, Bonavista Peninsula	Fermeuse Formation	Liu et al. (2014)	
	*Hiemalora*	Russian Platform, Siberia, Podolia and White Sea Region, Khorbusuonka River, Olenek Uplift. Mackenzie Mountains, Sekwi Brook. Avalon and Bonavista Peninsulas. South China, 3 Gorges.	Khatyspyt Formation. Sheepbed Formation. Mistaken Point – Fermeuse Formations. Shibantan Member.	Fedonkin (1981); Narbonne (1994); Gehling et al. (2000); Hofmann et al. (2008); Fedonkin et al. (2007); Chen et al. (2014)	
	*Inaria*	Russia, White Sea region	Vendian Group	Grazhdankin (2004)	
	*Inkrylovia*	Mackenzie Mountains, Sekwi Brook	Lower Blueflower Formation	Sperling et al. (2015)	Reconstructed after Fig 253 in Fedonkin et al. (2007)
	Ives-headiomorph	Newfoundland. England, Charnwood Forest	Drook – Fermeuse Formations. Charnian Supergroup	Boynton and Ford (1996); Liu et al. (2011)	Post-mortem decay (Liu et al., 2011)

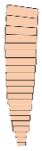
					
	*Kimberella*	Australia. Russia, Winter Coast, White Sea region.	Rawnsley Quartzite. Vendian Group	Glaessner and Daily (1959); Fedonkin and Waggoner (1997)	
	*Kuibisia glabra*	Witputs subbasin, Farm Plateau	Dabis Formation (Kliphoek Member?)	Hahn and Pflug (1985)	Uncertain affinity. Possibly *Ernietta* (Runnegar, 1992) or external surface of *Ausia* (Fedonkin et al., 2007)
	*Namalia*	Witputs subbasin, multiple localities. Aus-Buchholzbrunn to Helmeringhausen	Kliphoek Member	Germs (1968)	
	*Nasepia altae*	Witputs subbasin, Farm Swartpunt, Farm Arimas. Australia, Rawnsley Quartzite.	Spitskop Member, Nasep Member. Ediacara Member.	Germs (1973a); Darroch et al. (2015); Gehling and Droser (2013)	

	*Nilpenia*	Nilpena, Flinders Ranges	Rawnsley Quartzite, Ediacara Member	Droser et al. (2015)	
	*Onegia*	Russia, White Sea region.	Vendian Group	Grazhdankin (2004)	Considered synonymous with *Pteridinium* (Fedonkin et al., 2007)
	*Orthogonium parallelum*	Nama Group, Witputs subbasin, Farm Kuibis	Kliphoek Member	Gurich (1930b, 1933); Germs (1995); Pickford (1995)	Only specimen lost in WW2
	*Palaeopasichnus*	Nama Group, Witputs subbasin. Yudoma Group, Yudoma-Maya confluence	Kliphoek Member. Aim Formation	Jensen et al. (2000); Zhu et al. (2017)	FB personal observation: *Palaeopasichnus* at base of Upper Omkyk Member, Farm

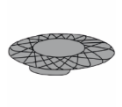
					Omkyk
	*Palaeophragmodictya*	South Australia. White Sea Region	Ediacara Member	Gehling and Rigby (1996); Serezhnikova (2007)	Probable sponge (Gehling and Rigby, 1996). Problematica with both sponge and coelenterate morphology (Serezhnikova, 2007)
	*Paracharnia*	South China, Hubei, Wuhe section.	Dengying Formation, Shibantan Member	Sun (1986)	
	*Parvancorina*	Australia. Russia, White Sea region	Rawnsley Quartzite. Vendian Group.	Glaessner (1958); Grazdankin (2004); Ivantsov et al. (2004); Naimark and Ivantsov (2009)	
	*Primocandelabrum*	Newfoundland. Bonavista Peninsula. England, Charnwood Forest.	Mistaken Point – Fermeuse Formations. Mercian assemblage.	Hofmann et al. (2008); Wilby et al. (2011)	
	*Protechiurus edmondsi*	Witputs subbasin, Farm Plateau	Dabis Formation, Kliphoek Member?	Glaessner (1979)	Dubiofossil? (Runnegar, 1992) or proto-chordate? Pickford (1995); Fedonkin et al. (2007)
	*Pteridinium*	Witputs subbasin, Farm Swartpunt, 25km north of Farm Helmeringhausen (Kosos?), Farm Aar. South China, 3 Gorges, Hubei. Australia. North Carolina, Stanley County, Carolina Slate Belt.	Spitskop Member, Vingerbreek Member, Niederhagen Member, Upper Kliphoek (Aar) Member. Shibantan Member. Rawnsley Quartzite.	Gurich (1930b, 1933); Glaessner (1963); Pflug (1970); Grant (1990); Germs (1995); Narbonne et al. (1997); Elliott et al. (2011); Chen et al. (2014); Gehling and Droser (2013). Gibson et al. (1984)	
	*Rangea*	Witputs subbasin, Farms Kuibis, Vrede, Aar and Chamis. South China, 3 Gorges, Hubei. Austrlia.	Niederhagen Member, Kliphoek Member. Shibantan Member. Rawnsley Quartzite.	Gurich (1930a, b); Germs (1973a); Jenkins (1985); Grant (1990); Vickers-Rich et al. (2013); Chen et al. (2014); Gehling and Droser (2013)	
	*Shaanxilithes*	Nama Group: Zaris subbasin, Road transect (D850). South China: Shaanxi, Lijiagou,	Vingerbreek Member. Gaojiashan Member. Aim Formation.	Darroch et al. (2016). Xing et al. (1984); Bengtson and Zhao (1992);	*Shaanxilithes* in Vingerbreek Member may be similar to described

		Kuanchuanpu and Gaojiashan sections. Eastern Siberia, Nuuchchalakh valley		Weber et al. (2007); Zhu et al. (2017)	*Palaeopasichnus delicatus/linearis* (Kolesnikov, 2018; A. Yu. Zhuravlev, pers. com.)
	*Spriggina*	Australia	Rawnsley Quartzite	Glaessner (1958); Gehling and Droser (2013)	
	*Stromatoveris*	South China, Yunnan, Meishucun, Jianshan	Chengjiang Formation	Shu et al. (2006)	
	*Swartpuntia*	Witputs subbasin, Farm Swartpunt. Nevada.	Spitskop Member, Feldschuhhorn Member. Wood Canyon Formation.	Narbonne et al. (1997); Jensen et al. (2000); Hagadorn and Waggoner (2000)	
	*Thaumaptilon*	British Columbia, Walcott Quarry	Stephen Formation	Conway Morris (1993)	

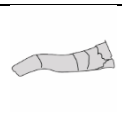
	*Trepassia wardae*	Newfoundland, Avalon Peninsula, Spaniard's Bay	Drook-Trepassey Formations	Narbonne and Gehling (2003); Narbonne et al. (2009)	Originally attributed to *Charnia wardi*
	*Tribrachidium*	Australia. Ukraine, Podolia. Russia, White Sea region.	Rawnsley Quartzite. Vendian Group.	Glaessner and Daily (1959); Fedonkin (1983); Fedonkin et al. (2007)	
	Vase-shaped microfossils (VSM)	South China, Shaanxi, Gaojiashan section.	Dengying Formation, Gaojiashan Member	Hua et al. (2007)	

					
	*Velancorina martina*	Witputs subbasin, Farms Aar and Schakalskuppe	Kuibis Formation (Kliphoek Member)	Pflug (1966)	Phylum Petalonamae
	*Ventogyrus*	Russia, White Sea region, Onega River.	Vendian Group	Ivantsov and Grazhdankin (1997); Fedonkin and Ivantsov (2007)	
	*Windermeria*	Mackenzie Mountains, Sekwi Brook	Upper Blueflower Formation	Narbonne (1994)	
	*Wutubus*	South China, 3 Gorges, Hubei	Shibantan Member	Chen et al. (2014)	
	*Yangtziramulus*	South China, Hubei, Muzhuxia and Miaohe sections.	Dengying Formation, Shibantan Member	Xiao et al. (2005); Shen et al. (2009)	
	*Yorgia*	Russia, Winter Coast, White Sea Region.	Vendian Group	Ivantsov (1999)	

Skeletal					
	*Cloudina*	1) Zaris subbasin, Farms Zwartmodder, Omkyk, Zebra River, Donkergange, Driedoornvlakte. Witputs subbasin, Farm Swartpunt, Farm Mooifontein, Farm Uitsig, Namibia. Vioolsdrif region (South Africa). 2) Shaanxi, South China. 3) Southeast Siberian Craton.	1) Spitskop, Huns, Hoogland, Upper Omkyk, Mooifontein, Mara members. 2) Dengying Fm, Gaojiashan and Beiwan members. 3) Yudoma Group. 4) Ibor Group. 5) Lower Ara Group. 6) Stirling Quartzite, Lower	Germs (1972b, 1995); Grant (1990); Mehra and Maloof (2018); Penny et al. (2014); Wood and Curtis (2015); Wood et al. (2017a). Hua et al. (2007); Cai et al. (2017). Zhu et al. (2017).	Probable total group cnidarian. Two possible species in Namibia: *hartmannae* and *riemkeae* but based on growth mode not size distribution (Germs, 1972a; Wood et al., 2017a). Additional two species noted in

		4) Iberian Peninsula, Spain. 5) Arabian-Nubian Shield, Oman. 6) Montgomery Mountains, Nevada. 7) Mexico 8) Brazil	Wood Canyon, Reed dolomite, and Deep Spring Fm. 7) La Ciénega Fm. 8) Tamengo Formation.	Zhuravlev et al. (2012). Signor et al. (1987); Smith et al. (2017). Sour-Tovar et al. (2007). Becker-Kerber et al. (2017)	South China: *C. ningqiangensis* and *C. xuanjiangping-ensis* (Cai et al., 2017). *Cloudina carinata* noted in Spain (Cortijo et al., 2010)
	*Hyolithellus*	North Greenland, Lower Cambrian	Buen and Aftenstjerneso Formations	Skovsted and Peel (2011)	
	*Multiconotubus chinensis*	South China, Shaanxi, Lijiagou section	Dengying Formation, Beiwan Member	Cai et al. (2017)	
	*Namacalathus*	Zaris subbasin, Farms Zwartmodder, Omkyk, Zebra River, Driedoornvlakte. Witputs subbasin, Farms Swartpunt, Swartkloofberg and Grens	Spitskop, Feldschuhhorn, Upper Omkyk and Kliphoek members	Grotzinger et al. (1995); Watters (MSci thesis, MIT, 2000); Wood et al. (2015); Penny et al. (2017)	Putative lophophorate (Zhuravlev et al., 2015)
	*Namapoikia*	Zaris subbasin, Farm Driedoornvlakte	Omkyk Member	Wood et al. (2002); Wood and Penny (2018)	Probable poriferan
	*Sinotubulites*	Siberia. Spain. Mexico. South China.		Zhao et al. (1988); Chen et al. (2008); Zhuravlev et al. (2012); Cai et al. (2015)	
	*Suvorovella*	Eastern Siberia, Yudoma – Maya depression	Aim Formation	Vologdin and Maslov (1960); Wood et al. (2017b)	

	*Anabarites*				
	Cambrotubulus			Rozanov et al. (1969); Zhuravlev et al. (2012)	

					
	*Chancelloriid*	South China, Chengjiang. Utah, Wheeler Shale. Canada. Siberia. Mongolia. Australia.	Early-Middle Cambrian. Yuanshan Formation. Wheeler Shale. Burgess Shale.	Walcott (1920); Bengtson et al. (1990); Bengtson and Hou (2001); Janussen et al. (2002)	
	*Fomitchella*			Clarkson (1979)	
	*Halkieriid*			Conway Morris and Peel (1990); Porter (2004)	
	*Orthothecimorph*			e.g. Novozhilova (2013)	
	*Protoherzina*			Clarkson (1979)	

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