GSA Data Repository 2019003

Sinclair, H.D., et al., 2019, Detrital cosmogenic ^{21}Ne records decoupling of source-to-sink signals by sediment storage and recycling in Miocene to present rivers of the Great Plains, Nebraska, USA: Geology, https://doi.org/10.1130/G45391.1.

SUPPLEMENTARY MATERIAL

A.

B.

C.

Supplementary Figures DR1a,b,c. Sample location for Miocene Quartzite Pebbes at the spillpoint of Lake McConaughy, Keith County, Nebraska. 41.20481°N, 101.6676°W. The spillpoint was cut in 20th century, and so sample-site was shielded by ~8m of overburden before that.

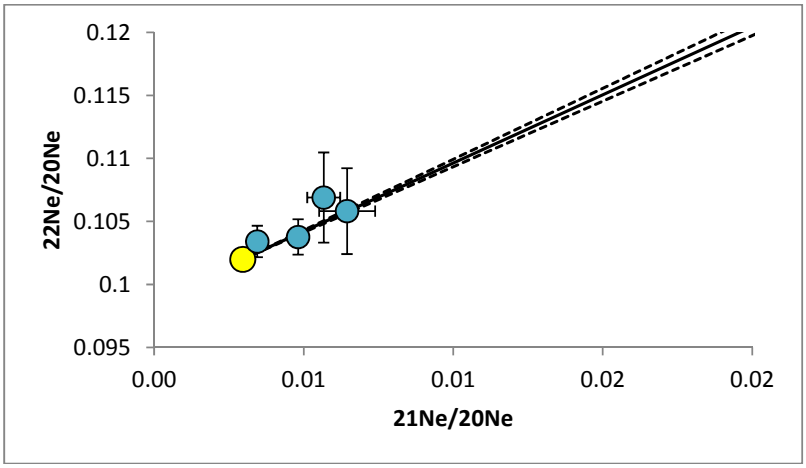
Supplementary **Figure DR2**. Sample location for Pliocene channel pebbles of quartzite, approximately 30 km northwest from the edge of Lake McConaughy, Keith County, Nebraska. 41.49704°N, 102.1728°W. Samples were taken from the base of the section that was ~3m below the modern ground surface.

A.

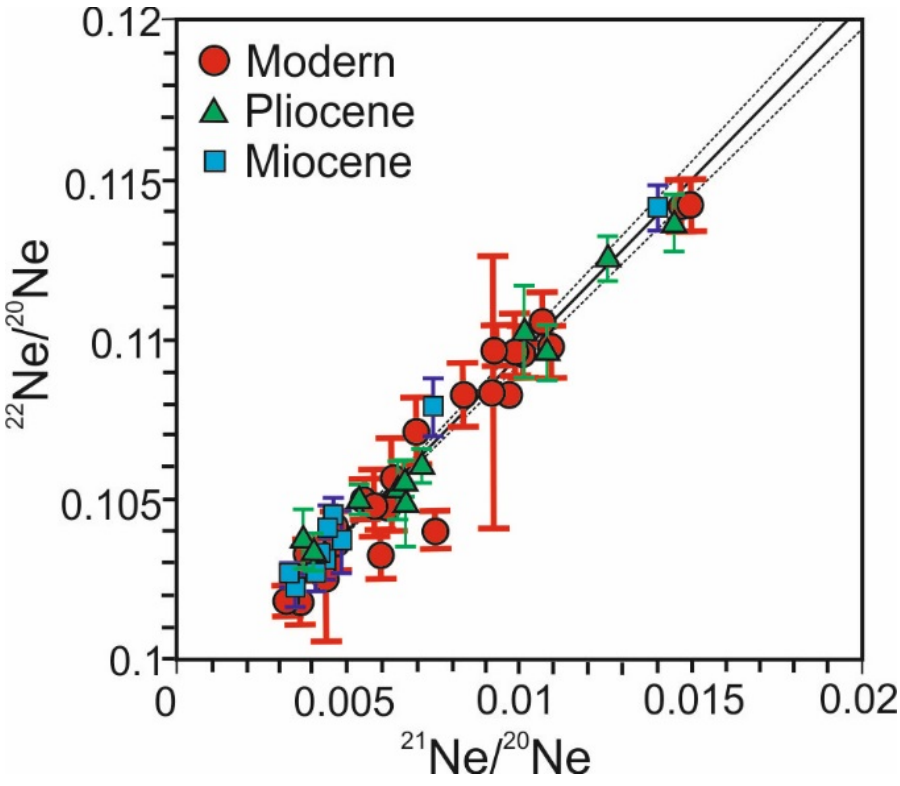
B.

Supplementary Figure DR3. Sample location for modern North Platte River downstream of Lake McConaughy, near Keystone, Keith County, Nebraska. 41.21097°N, 101.5956°W. A. Overview of braided channel view from bridge. B. Close-up of bar surface from where quartzite clasts were chosen.

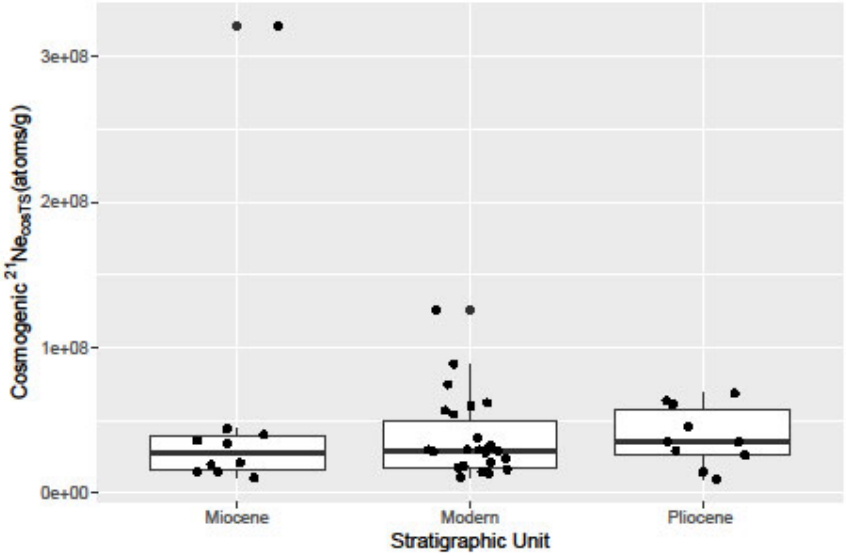
Supplementary figure DR4. Sample of shielded basement quartzite from the Medicine Bow Mountains. 41°19'32.92"N, 106°19'28.42"W. Samples were taken from the base of the roadcut, at least 10m below erosion surface.



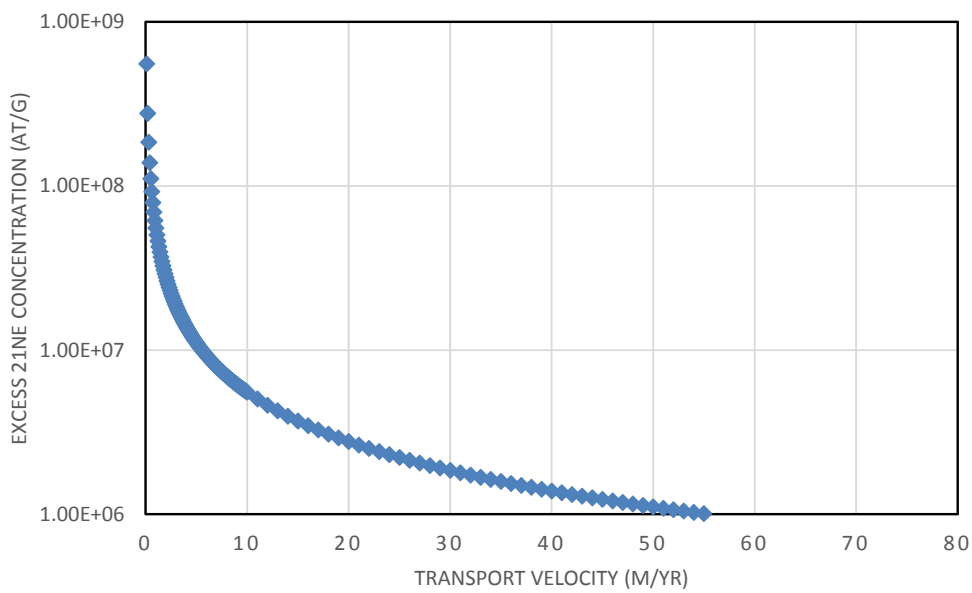
Supplementary Figure DR5. A. Neon isotope composition of bedrock samples of the shielded quartzite exposures of the Medicine Bow Quartzite located in supplementary figure 4. Solid line represents the ratio of the air-spallation line on which all cosmogenic 21Ne must plot. Dashed lines represent one standard error.



Supplementary Figure DR6. A. Neon isotope composition of quartzite pebbles from modern, Pliocene and Miocene samples from locations shown in supplementary figures 1,2 & 3. See Supplementary Table 1 for data. Solid line is air-spallation line with one standard error in dashed line.



Supplementary Figure DR7. Box plot of $^{21}Ne_{cosTS}$ data from Miocene, Pliocene and modern of North Platte River. The black line shows the median, the limits of the box are the 25th and 75th percentiles. The upper whisker extends from the hinge to the largest value no further than 1.5 * IQR from the hinge (where IQR is the inter-quartile range, or distance between the first and third quartiles). The lower whisker extends from the hinge to the smallest value at most 1.5 * IQR of the hinge. Data beyond the end of the whiskers are called "outlying" points and are plotted individually. The data-points have been added with jitter for clarity.



Supplementary Figure DR8. - Modelled $^{21}Ne_{cosTS}$ at the sample point for the modern sediment samples, ~1050 km downstream from the source area of the sample in the Medicine Bow Mountains (Supplementary Fig. 3). Concentrations are plotted for varying sediment transport rates down the river system. Inputs are the modern long river profile of the North Platte River, Ne productions rates as a function of elevation and location. We use the Stone/Lal production scaling. The production rate of ^{21}Ne is determined based on the ^{10}Be production rate of Borchers et al (2016) and the ratio between ^{10}Be and

^{21}Ne of Balco & Shuster 2009. This results in a sea level high latitude production rate of 16.63 atoms/g/yr for ^{21}Ne. The assumption here is that the sediment is always exposed during transport, and that there is no abrasion of pebbles – clearly this is unrealistic, but can be used as an end member model experiment.
The model code is based on Mudd et al. (2016), and is available on https://github.com/LSDtopotools/LSDTopoTools_CRNBasinwide and the program is CRN_21Ne_river.cpp

REFERENCE

Borchers, B., Marrero, S., Balco, G., Caffee, M., Goehring, B., Lifton, N., Nishiizumi, K., Phillips, F., Schaefer, J. and Stone, J., (2016), Geological calibration of spallation production rates in the CRONUS-Earth project. *Quaternary Geochronology*, *31*, pp.188-198.

Mudd, S.M., Harel, M.A., Hurst, M.D., Grieve, S.W. and Marrero, S.M., (2016). The CAIRN method: automated, reproducible calculation of catchment-averaged denudation rates from cosmogenic nuclide concentrations. *Earth Surface Dynamics*, *4*(3), pp.655-674.

Analysis date	Run number	Sample name	Weight (mg)	21Ne/20Ne	1σ	21Ne*at/g	1σ	22Ne/20Ne	1σ
Basement MB Quartzite									
09/09/2013	bz057	Qz7 (2) A	115.6	0.00567	0.00028	**6.09E+06**	1.5E+06	0.10690	0.00179
09/09/2013	bz058	Qz8 (a)	174	0.00481	0.00015	**7.70E+06**	9.7E+05	0.10376	0.00070
18/09/2013	bz097	Qz7 (1) B	146.3	0.00645	0.00047	**7.29E+06**	1.9E+06	0.10581	0.00170
18/09/2013	bz098	Qz5 B	131.5	0.00345	0.00010	**2.19E+06**	1.1E+06	0.10341	0.00062
Miocene pebbles									
27/09/2013	BZ148	PCUOA 1	180.8	0.00465	0.00010	**1.48E+07**	1.1E+06	0.10445	0.00055
27/09/2013	BZ150	PCUOB 2	168.1	0.00765	0.00023	**3.61E+07**	2.1E+06	0.10780	0.00091
01/03/2013	bz166	LMOG A3	149.8	0.00489	0.00010	**4.42E+07**	2.0E+06	0.10365	0.00103
02/10/2013	bz169	LMOG E2	130.6	0.00452	0.00013	**1.08E+07**	1.3E+06	0.10406	0.00067
03/10/2013	BZ176	LMOG D1	138.4	0.00430	0.00012	**2.09E+07**	1.5E+06	0.10318	0.00043
08/10/2013	bz197	LMOG C1&2	205.7	0.00336	0.00007	**1.45E+07**	9.3E+05	0.10260	0.00038
26/02/2014	cb034	LMOG I2	131.8	0.00354	0.00003	**1.94E+07**	8.4E+05	0.10217	0.00058
26/02/2014	cb036	LMOG H2	191.5	0.00443	0.00007	**3.42E+07**	1.3E+06	0.10312	0.00067
26/02/2014	cb037	LMOG J1	152.6	0.01427	0.00011	**3.21E+08**	1.0E+07	0.11400	0.00075
06/03/2014	cb068	PCUO A3	182.5	0.00414	0.00005	**4.01E+07**	1.5E+06	0.10266	0.00059
Pliocene pebbles									
27/09/2013	BZ147	BCBR2 A	185.3	0.01070	0.00021	**4.58E+07**	2.0E+06	0.10959	0.00084
02/10/2013	bz170	DRRR A1	134.1	0.00394	0.00015	**9.77E+06**	1.3E+06	0.10340	0.00058
02/10/2013	bz171	DRRR B2	187.8	0.01006	0.00026	**3.56E+07**	1.8E+06	0.11024	0.00144
02/10/2013	BZ172	BCBR E1	149.7	0.00360	0.00007	**1.45E+07**	1.1E+06	0.10381	0.00092
02/10/2013	BZ173	BCBR B1	159.9	0.00659	0.00022	**3.52E+07**	2.1E+06	0.10493	0.00135
04/10/2013	bz180	BW71 A1	115.2	0.00637	0.00044	**2.94E+07**	3.6E+06	0.10531	0.00091
08/10/2013	BZ196	BW 71 B1	135.8	0.01250	0.00023	**6.36E+07**	2.7E+06	0.11253	0.00070
27/02/2014	cb043	BCBR2 G2	165.9	0.01443	0.00019	**6.87E+07**	2.5E+06	0.11362	0.00090
28/02/2014	cb048	BCBR2 J2	161.8	0.00708	0.00007	**6.11E+07**	2.1E+06	0.10610	0.00056
06/03/2014	cb065	BCBR2 K2	169.5	0.00524	0.00003	**2.62E+07**	9.5E+05	0.10498	0.00053
Modern pebbles									
19/09/2013	bz106	GP32B 1	145.9	0.00457	0.00010	**1.76E+07**	1.3E+06	0.10418	0.00043
19/09/2013	bz107	GP32A 1	136.4	0.00321	0.00004	**1.09E+07**	1.1E+06	0.10179	0.00054
19/09/2013	bz108	GP32E 1	140	0.00929	0.00017	**5.69E+07**	2.5E+06	0.10967	0.00075
23/09/2013	bz114	GP32C 1	134.9	0.00625	0.00012	**2.99E+07**	1.7E+06	0.10526	0.00078
23/09/2013	bz117	GP32D 1	172.9	0.00466	0.00009	**2.97E+07**	1.5E+06	0.10385	0.00045
24/09/2013	bz121	GP32G 1	118.8	0.00464	0.00021	**1.50E+07**	1.7E+06	0.10363	0.00083
26/09/2013	bz137	GP32F 2	139.4	0.00622	0.00021	**1.47E+07**	1.4E+06	0.10542	0.00147
26/09/2013	bz138	GP32G 2	204.9	0.00547	0.00012	**2.11E+07**	1.2E+06	0.10497	0.00063
26/09/2013	bz139	GP32H 2	132.1	0.00923	0.00038	**1.77E+07**	1.5E+06	0.10833	0.00430
27/09/2013	bz141	KRA1-2	199.7	0.00381	0.00007	**1.62E+07**	9.7E+05	0.10329	0.00045
27/09/2013	bz142	KRB 2	134.4	0.00609	0.00013	**6.21E+07**	2.8E+06	0.10475	0.00072

27/09/2013	bz145	KRC 1	147.2	0.01012	0.00078	**5.99E+07**	7.1E+06	0.10960	0.00076
27/09/2013	bz146	KRD1	144.1	0.00571	0.00014	**2.84E+07**	1.7E+06	0.10484	0.00108
07/03/2014	cb074	KRC3	96.6	0.00836	0.00015	**5.42E+07**	2.3E+06	0.10825	0.00105
29/03/2017	cz115	M-L-14	163.8	0.00986	0.00036	**3.12E+07**	1.9E+06	0.10956	0.00124
29/03/2017	cz116	M-L-5	162.7	0.00699	0.00024	**2.36E+07**	1.6E+06	0.10707	0.00107
30/03/2017	cz120	M-L-8	162.3	0.01068	0.00039	**3.81E+07**	2.3E+06	0.11053	0.00097
30/03/2017	cz121	M-L-10	151.5	0.00359	0.00010	**1.88E+07**	3.1E+06	0.10182	0.00079
31/03/2017	cz124	M-L-6	164.5	0.00437	0.00025	**1.31E+07**	2.4E+06	0.10252	0.00198
31/03/2017	cz127	M-L-11	161.8	0.00590	0.00018	**3.28E+07**	2.2E+06	0.10330	0.00080
31/03/2017	cz126	M-L-7	182.7	0.00630	0.00024	**2.79E+07**	2.1E+06	0.10562	0.00125
06/04/2017	cz136	M-L-2	168.4	0.01501	0.00035	**8.88E+07**	3.6E+06	0.11420	0.00081
06/04/2017	cz137	M-L-9	194.9	0.00964	0.00022	**2.98E+07**	1.3E+06	0.10822	0.00110
06/04/2017	cz138	M-L-13	152.7	0.01475	0.00027	**1.26E+08**	4.7E+06	0.11417	0.00080
07/04/2017	cz141	M-L-12	183.2	0.01095	0.00041	**2.89E+07**	1.7E+06	0.10976	0.00104
07/04/2017	cz142	M-L-1	180.0	0.00751	0.00017	**7.48E+07**	3.5E+06	0.10398	0.00062

Supplementary Table DR1. Isotope measurements for Ne on all samples. Note that the $^{21}Ne^{*}$ values are in bold, and that the $^{21}Ne_{cosTS}$ values in text represent the 21Ne* values minus the maximum inherited combined $^{21}Ne_{nuc}$ and $^{21}Ne_{ex}$ of 0.85×10^{7} at/g.