Ross, C.H., Stockli, D.F., Rasmussen, C., Gulick, S.P.S., de Graaff, S.J., Claeys, P., Zhao, J., Xiao, L., Pickersgill, A.E., Schmieder, M., Kring, D.A., Wittmann, A., and Morgan, J.V., 2021, Evidence of Carboniferous arc magmatism preserved in the Chicxulub impact structure: GSA Bulletin, <https://doi.org/10.1130/B35831.1>.

Supplemental Material

Appendix Figure 1. Core-Rim zircon relationships from samples 105R3 (n = 5), 145R1 (n = 4), 209R2 (n = 1), and 235R2 (n = 1). Black line represents the 1:1 line or where there is no core-rim age difference. Another four grains revealed a cluster of ages in the Late Carboniferous (324–295 Ma) and rim ages ranging between 281 and 211 Ma and likely suffer from Pb loss. Error bars are 2 σ for both the rim and core.

Appendix Figure 2. Discrimination plots after Hoskin (2005). Chondrite-normalized (Sm/La)_N ratio versus La (ppm). Dark gray and light gray (determined by Jack Hills zircon) fields are from Hoskin (2005).

Appendix Table 1. Previously reported ages from the ejecta and cores constraining the Maya Block's tectonic history (see Fig. 8). Italicized text indicates ejecta studies while black text describes bedrock studies. Description of material used, location, analysis type, and references included. Modified after Kettrup and Deutsch (2003).

Appendix Figures 3–23. Wetherill Concordia diagrams and weighted mean age calculations using different filters for each sample. If the sample needed all the filters there are 4 plots (a–d), but not all samples needed all the filtering (ex. samples without inherited components). (a) Wetherill Concordia diagrams for the sample displaying grains with <30% discordance. Ellipses are color coded by U concentration and represent 2 σ uncertainties. (b) Wetherill Concordia diagrams for the sample manually excluding inherited grains, Pb loss, and common Pb. (c) Stack plot of $^{206}\text{Pb}/^{238}\text{U}$ single grain ages that are <15% discordant. Each vertical bar represents one zircon grain age and 2 σ uncertainty (color coded by U concentration). The black horizontal bar is the weighted mean age. The gray horizontal bar indicates the uncertainty of the weighted mean age. Blue vertical bars indicate rejected ages from the weighted mean age calculation. (d) Stack plot of $^{206}\text{Pb}/^{238}\text{U}$ single grain ages that are <5% discordant.

Appendix Figure 24. Stack plot of $^{206}\text{Pb}/^{238}\text{U}$ of Plesovice (secondary standard) from all LAICPMS runs. Each vertical bar represents one zircon age and 2 σ uncertainty (color coded by U concentration). The black horizontal bar is the weighted mean age. The gray horizontal bar indicates the uncertainty of the weighted mean age.

Raw Data

APPENDIX I

FIGURES AND TABLES

Appendix Figure 1. Core-Rim zircon relationships from samples 105R3 (n=5), 145R1 (n=4), 209R2 (n=1), and 235R2 (n=1). Black line represents the 1:1 line or where there is no core-rim age difference. Another four grains revealed a cluster of ages in the Late Carboniferous (324-295 Ma) and rim ages ranging between 281 and 211 Ma and likely suffer from Pb loss. Error bars are 2σ for both the rim and core.

Appendix Figure 2. Discrimination plots after Hoskin (2005). Chondrite-normalized $(\text{Sm/La})_N$ ratio vs. La (ppm). Dark grey and light grey (determined by Jack Hills zircon) fields are from Hoskin (2005).

Material/locality	Basement age (Ma)	Protolith age (Ga)	Method (Reference)
<i>Zircon - Chicxulub, K-Pg Beloc, K-Pg CO</i>	<i>545 ± 5, 418 ± 6</i>	-	<i>U-Pb (Krogh et al., 1993a)</i>
<i>Zircon - K-Pg CO</i>	<i>550 ± 10</i>	-	<i>U-Pb (Krogh et al., 1993b)</i>
<i>Zircon - K-Pg CO</i>	<i>571 ± 6</i>		<i>U-Pb (Premo & Izett, 1993)</i>
<i>Zircon - K-Pg Saskatchewan</i>	<i>548 ± 8</i>	-	<i>U-Pb (Kamo & Krogh, 1995)</i>
<i>Zircon - Silurian, Maja Mtns</i>	<i>418 ± 4, 404 ± 3</i>	<i>1.210 ± 0.136</i>	<i>U-Pb (Steiner & Walker, 1996)</i>
<i>Zircon - Yax-1</i>	<i>536 ± 12, 445 ± 13, 450 ± 39</i>	-	<i>U-Pb (Schmieder et al., 2017)</i>
<i>Zircon - Spain</i>	<i>549.5 ± 5.7</i>	-	<i>U-Pb (Kamo et al., 2011)</i>
<i>Zircon - Yax-1</i>	<i>546 ± 5</i>	-	<i>U-Pb (Keppie et al., 2011)</i>
<i>Impact melt - C1</i>	-	<i>1100</i>	<i>T_{DM (Nd)} (Kettrup et al., 2000)</i>
<i>Impact glass- K-Pg Beloc</i>	-	<i>1100</i>	<i>T_{DM (Nd)} (Kettrup et al., 2000)</i>
<i>Impact melt - Y6</i>	<i>413, 565.9, 635, 812, 939</i>	<i>1.2-1.4 (n=4)</i>	<i>T_{CHUR}, T_{DM (Nd)} (Kettrup et al., 2000)</i>
<i>Impact glass- K-Pg Beloc</i>	-	<i>1.08</i>	<i>T_{DM (Nd)} (Premo & Izett, 1992)</i>
<i>Impact melt - C1</i>	-	<i>1.06</i>	<i>T_{DM (Nd)} (Blum et al., 1993)</i>

Appendix Table 1. Previously reported ages from the ejecta and cores constraining the Maya Block's tectonic history (see Fig. 8). Italicized text indicates ejecta studies while black text

describes bedrock studies. Description of material used, location, analysis type, and references included. Modified after Kettrup et al. (2003).

104R3

105R3

A. Wetherill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = $325.93 \pm 0.31 \mid 0.62 \mid 4.58$ (n=71/71)
MSWD = 55.2, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = $330.00 \pm 0.35 \mid 0.70 \mid 4.72$ (n=55/55)
MSWD = 46.0, $p(\chi^2) = 0$

106R2

A. Concordia excluding inherited, common Pb, & Pb loss

B. Weighted mean age: <15% discordance

C. Weighted mean age: <5% discordance

107R3

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = 316.40 ± 0.72 | 1.52 | 4.67 (n=17/17)
MSWD = 9.42, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = 309.85 ± 0.95 | 2.18 | 20.02 (n=9/9)
MSWD = 84.4, $p(\chi^2) = 0$

121R2

A. Wetherill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = 323.37 ± 0.51 | 1.04 | 3.95 (n=41/41)
MSWD = 14.6, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = 324.23 ± 0.66 | 1.36 | 5.12 (n=24/24)
MSWD = 14.1, $p(\chi^2) = 0$

123R1

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = $329.87 \pm 0.29 \mid 0.58 \mid 3.92$ (n=51/51)
MSWD = 45.8, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = $333.82 \pm 0.34 \mid 0.69 \mid 3.83$ (n=36/36)
MSWD = 30.7, $p(\chi^2) = 0$

145R1

A. Concordia excluding inherited, common Pb, & Pb loss

B. Weighted mean age: <15% discordance

C. Weighted mean age: <5% discordance

155R1

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

157R1

A. Concordia excluding inherited, common Pb, & Pb loss

B. Weighted mean age: <15% discordance

C. Weighted mean age: <5% discordance

158R1

A. Wetherhill Concordia <30% discordance

B. Weighted mean age: <15% discordance

C. Weighted mean age: <5% discordance

183R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

D. Weighted mean age: <5% discordance

184R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = $337.09 \pm 0.27 \mid 0.54 \mid 3.65$ (n=58/58)
MSWD = 46.4, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = $339.30 \pm 0.31 \mid 0.62 \mid 3.93$ (n=43/43)
MSWD = 39.7, $p(\chi^2) = 0$

209R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

D. Weighted mean age: <5% discordance

212R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = 320.41 ± 0.93 | 2.02 | 6.84 (n=14/16)
MSWD = 11.5, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = 328.36 ± 1.07 | 2.41 | 15.21 (n=10/10)
MSWD = 39.8, $p(\chi^2) = 0$

224R1

A. Concordia excluding inherited, common Pb, & Pb loss

B. Weighted mean age: <15% discordance

C. Weighted mean age: <5% discordance

235R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = 324.46 ± 0.89 | 1.93 | 3.71 (n=13/14)
MSWD = 3.68, $p(\chi^2) = 0.000015$

D. Weighted mean age: <5% discordance

mean = 325.99 ± 1.08 | 2.48 | 2.54 (n=9/10)
MSWD = 1.05, $p(\chi^2) = 0.39$

260R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = $320.42 \pm 0.73 \mid 1.53 \mid 6.62$ (n=21/21)
MSWD = 18.7, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = $321.29 \pm 0.77 \mid 1.62 \mid 6.44$ (n=19/19)
MSWD = 15.7, $p(\chi^2) = 0$

261R2

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = 321.17 ± 0.58 | 1.19 | 5.47 (n=30/30)
MSWD = 21.1, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = 321.32 ± 0.58 | 1.20 | 5.56 (n=29/30)
MSWD = 21.6, $p(\chi^2) = 0$

272R1

A. Wetherhill Concordia <30% discordance

B. Concordia excluding inherited, common Pb, & Pb loss

C. Weighted mean age: <15% discordance

mean = $322.02 \pm 0.85 \mid 1.84 \mid 13.56$ (n=14/14)
MSWD = 54.2, $p(\chi^2) = 0$

D. Weighted mean age: <5% discordance

mean = $328.79 \pm 1.16 \mid 2.84 \mid 7.52$ (n=7/8)
MSWD = 7.00, $p(\chi^2) = 0.00000018$

296R3

A. Wetherhill Concordia <30% discordance

B. Weighted mean age: <15% discordance

302R1

A. Wetherhill Concordia <30% discordance

B. Weighted mean age: <15% discordance

Appendix Figure 3-23. Wetherill Concordia diagrams and weighted mean age calculations using different filters for each sample. If the sample needed all the filters there are 4 plots (a-d), but not all samples needed all the filtering (ex. samples without inherited components). a) Wetherill Concordia diagrams for the sample displaying grains with <30% discordance. Ellipses are color coded by U concentration and represent 2σ uncertainties. b) Wetherill Concordia diagrams for the sample manually excluding inherited grains, Pb loss, and common Pb. c) Stack plot of $^{206}\text{Pb}/^{238}\text{U}$ single grain ages that are <15% discordant. Each vertical bar represents one zircon grain age and 2σ uncertainty (color coded by U concentration). The black horizontal bar is the weighted mean age. The gray horizontal bar indicates the uncertainty of the weighted mean age. Blue vertical bars indicate rejected ages from the weighted mean age calculation. d) Stack plot of $^{206}\text{Pb}/^{238}\text{U}$ single grain ages that are <5% discordant.

Appendix Figure 24. Stack plot of $^{206}\text{Pb}/^{238}\text{U}$ of Plesovice (secondary standard) from all LA-ICPMS runs. Each vertical bar represents one zircon age and 2σ uncertainty (color coded by U concentration). The black horizontal bar is the weighted mean age. The gray horizontal bar indicates the uncertainty of the weighted mean age.

REFERENCES CITED

- Blum, J.D., Chamberlain, C.P., Hingston, M.P., Koeberl, C., Marin, L.E., Schuraytz, B.C., and Sharpton, V.L., 1993, Isotopic comparison of K/T boundary impact glass with melt rock from the Chicxulub and Manson impact structures: *Nature*, v. 364, p. 325, <https://doi.org/10.1038/364325a0>.
- Hoskin, P.W., 2005, Trace-element composition of hydrothermal zircon and the alteration of Hadean zircon from the Jack Hills, Australia: *Geochimica et Cosmochimica Acta*, v. 69, p. 637–648, <https://doi.org/10.1016/j.gca.2004.07.006>.
- Kamo, S.L., and Krogh, T.E., 1995, Chicxulub crater source for shocked zircon crystals from the Cretaceous-Tertiary boundary layer, Saskatchewan: Evidence from new U-Pb data: *Geology*, v. 23, p. 281–284, [https://doi.org/10.1130/0091-7613\(1995\)023<0281:CCSFSZ>2.3.CO;2](https://doi.org/10.1130/0091-7613(1995)023<0281:CCSFSZ>2.3.CO;2).
- Kamo, S.L., and Krogh, T.E., 1995, Chicxulub crater source for shocked zircon crystals from the Cretaceous-Tertiary boundary layer, Saskatchewan: Evidence from new U-Pb data: *Geology*, v. 23, p. 281–284, [https://doi.org/10.1130/0091-7613\(1995\)023<0281:CCSFSZ>2.3.CO;2](https://doi.org/10.1130/0091-7613(1995)023<0281:CCSFSZ>2.3.CO;2).
- Kamo, S.L., Lana, C., and Morgan, J.V., 2011, U–Pb ages of shocked zircon grains link distal K–Pg boundary sites in Spain and Italy with the Chicxulub impact: *Earth and Planetary Science Letters*, v. 310, p. 401–408, <https://doi.org/10.1016/j.epsl.2011.08.031>.
- Keppie, J.D., Dostal, J., Norman, M., Urrutia-Fucugauchi, J., and Grajales-Nishimura, M., 2011, Study of melt and a clast of 546 Ma magmatic arc rocks in the 65 Ma Chicxulub bolide breccia, northern Maya block, Mexico: western limit of Ediacaran arc peripheral to northern Gondwana: *International Geology Review*, v. 53, p. 1180–1193, <https://doi.org/10.1080/00206810903545527>.
- Kettrup, B., Deutsch, A., Ostermann, M., and Agrinier, P., 2000, Chicxulub impactites: Geochemical clues to the precursor rocks: *Meteoritics & Planetary Science*, v. 35, p. 1229–1238, <https://doi.org/10.1111/j.1945-5100.2000.tb01511.x>.
- Kettrup, B., and Deutsch, A., 2003, Geochemical variability of the Yucatan basement: Constraints from crystalline clasts in Chicxulub impactites: *Meteoritics & Planetary Science*, v. 38, no. 7, p. 1079–1092, <https://doi.org/10.1111/j.1945-5100.2003.tb00299.x>.
- Krogh, T.E., Kamo, S.L., and Bohor, B.A., 1993a, Fingerprinting the K/T impact site and determining the time of impact by UPb dating of single shocked zircons from distal ejecta: *Earth and Planetary Science Letters*, v. 119, p. 425–429, [https://doi.org/10.1016/0012-821X\(93\)90150-8](https://doi.org/10.1016/0012-821X(93)90150-8).
- Krogh, T.E., Kamo, S.L., Sharpton, V.L., Marin, L.E., and Hildebrands, A.R., 1993b, U-Pb ages of single shocked zircons linking distal K/T ejecta to the Chicxulub crater: *Nature*, v. 366, p. 731, <https://doi.org/10.1038/366731a0>.
- Premo, W.R., and Izett, G.A., 1993, U-Pb provenance ages of shocked zircons from the KT boundary, Raton basin, Colorado: Presented at the Lunar and Planetary Science Conference, p. 1171.
- Schmieder, M., Shaulis, B.J., Lapen, T.J., and Kring, D.A., 2017, U–Th–Pb systematics in zircon and apatite from the Chicxulub impact crater, Yucatan, Mexico: *Geological Magazine*, v. 155, p. 1330–1350, <https://doi.org/10.1017/S0016756817000255>.
- Steiner, M.B., and Walker, J.D., 1996, Late Silurian plutons in Yucatan: *Journal of Geophysical Research. Solid Earth*, v. 101, p. 17727–17735, <https://doi.org/10.1029/96JB00174>.