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Supplementary Information

New 1-Hydroxy-1,1-bisphosphonates Derived from 1*H*-Pyrazolo[3,4-*b*]pyridine: Synthesis and Characterization

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- ^{1}H and ^{13}C NMR spectra for pyrazolo[3,4-*b*]pyridine ester derivatives substituted at N-1 (**3a** and **3b**) and N-2 (**4**)
- ^{1}H and ^{13}C NMR spectra for pyrazolo[3,4-*b*]pyridine carboxylic acid derivatives substituted at N-1 (**5a** and **5b**)
- ^{1}H, ^{13}C and ^{31}P NMR spectra for pyrazolo[3,4-*b*]pyridine bisphosphonates (**7a** and **7b**) and monophosphonate **8**
- Crystal data and structure refinement for compound **7a**

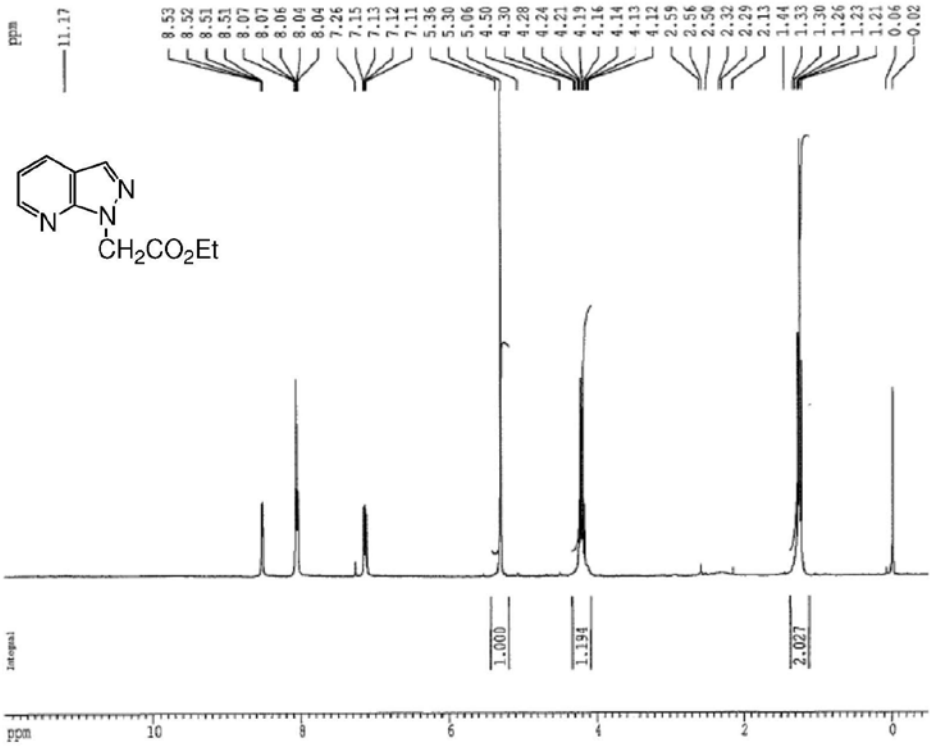

Figure S1. ^{1}H NMR spectrum (300 MHz, $CDCl_3$) of ethyl 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetate (**3a**).

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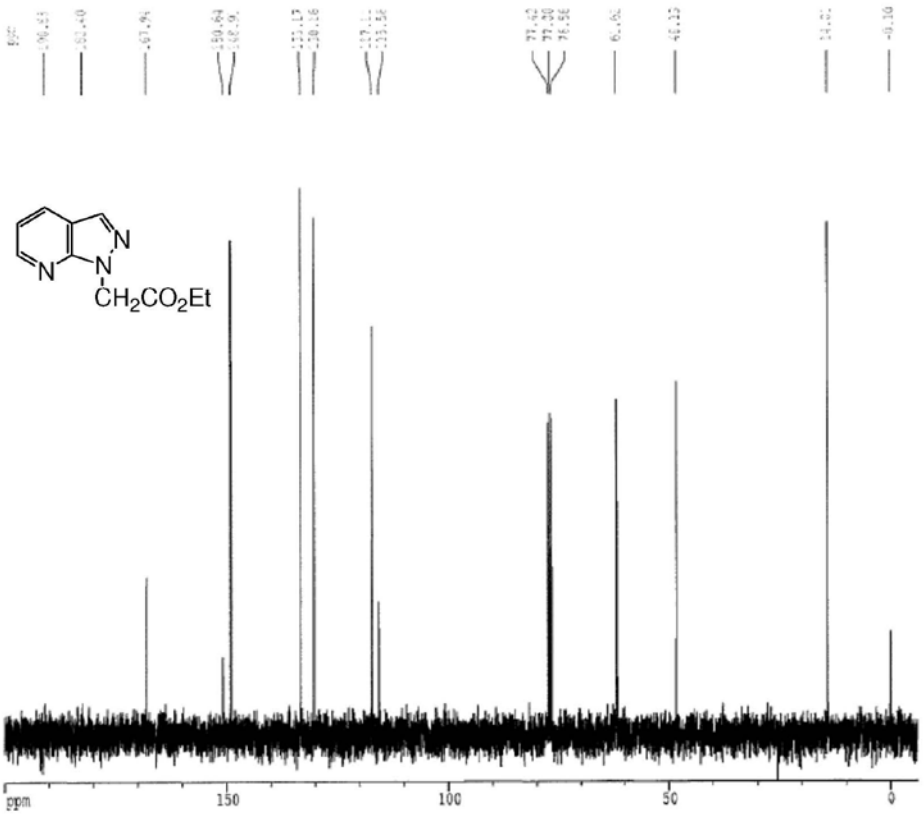

Figure S2. ^{13}C NMR spectrum (75 MHz, $CDCl_3$) of ethyl 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetate (**3a**).

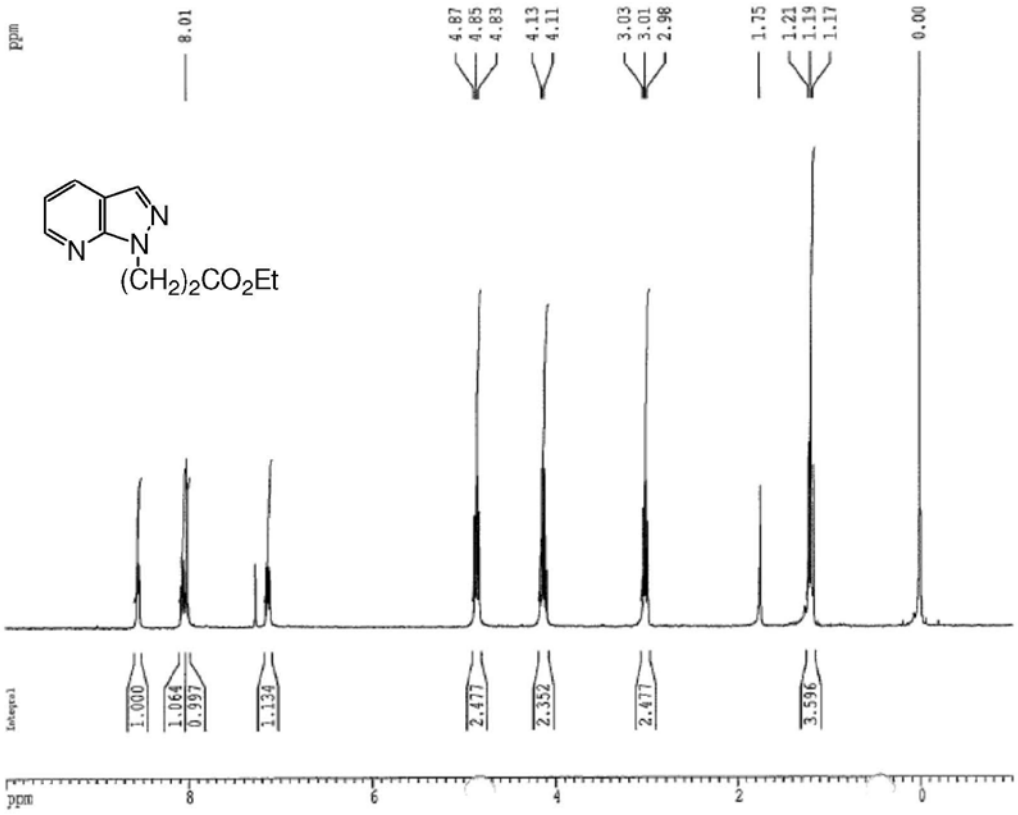

Figure S3. ^{1}H NMR spectrum (300 MHz, $CDCl_3$) of ethyl 3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propanoate (**3b**).

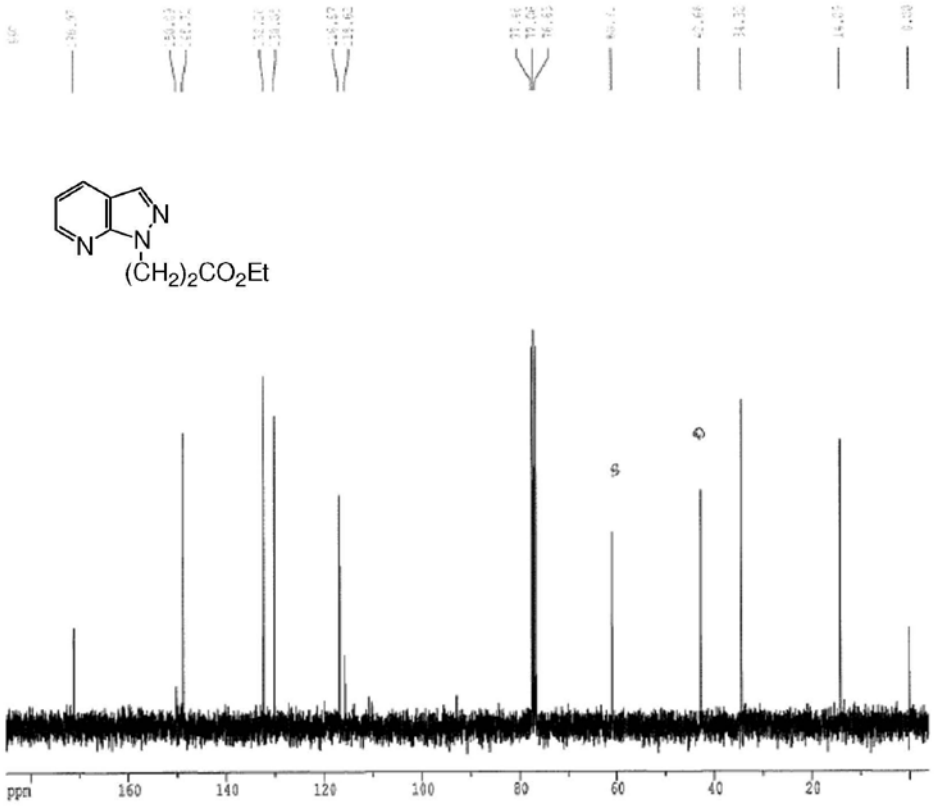

Figure S4. ^{13}C NMR spectrum (75 MHz, $CDCl_3$) of ethyl 3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propanoate (**3b**).

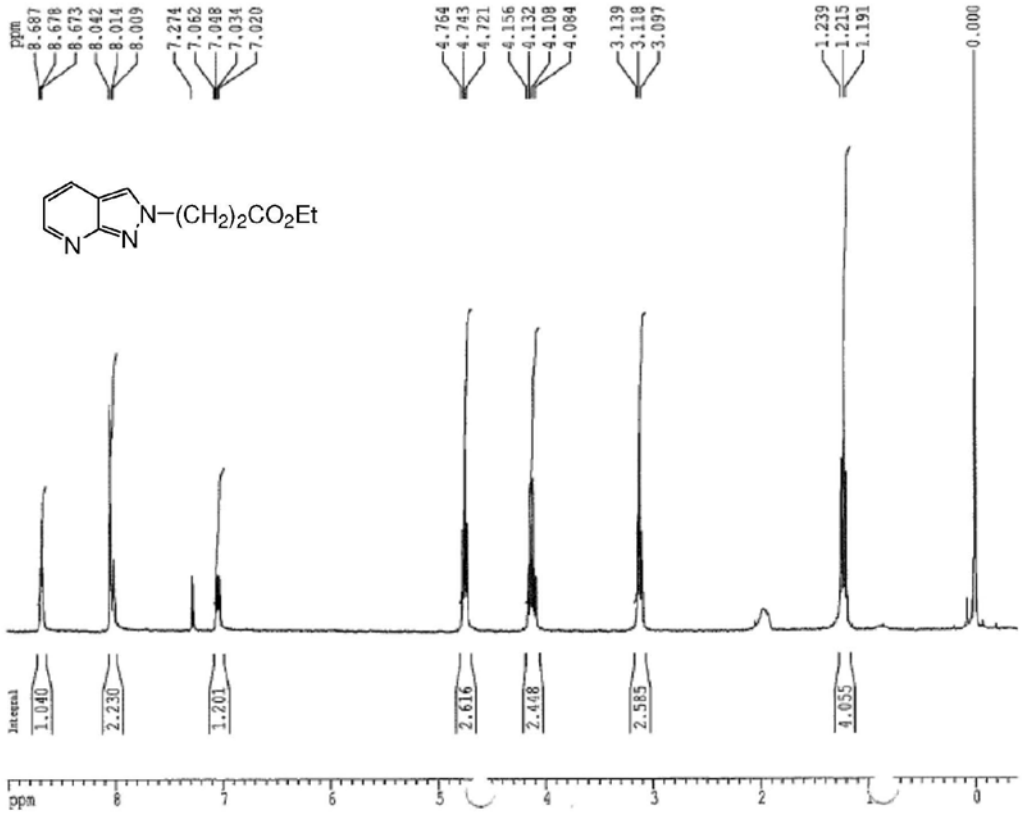

Figure S5. ^{1}H NMR spectrum (300 MHz, $CDCl_3$) of ethyl 3-(2*H*-pyrazolo[3,4-*b*]pyridin-2-yl)propanoate (**4b**).

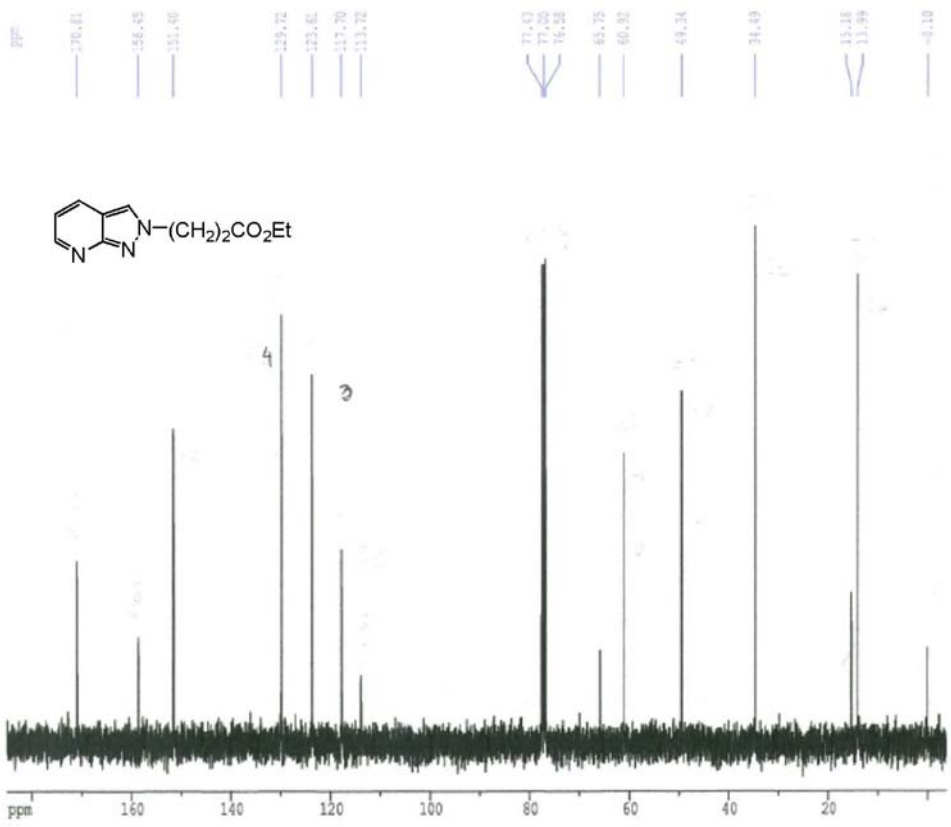

Figure S6. ^{13}C NMR spectrum (75 MHz, $CDCl_3$) of ethyl 3-(2*H*-pyrazolo[3,4-*b*]pyridin-2-yl)propanoate (**4b**).

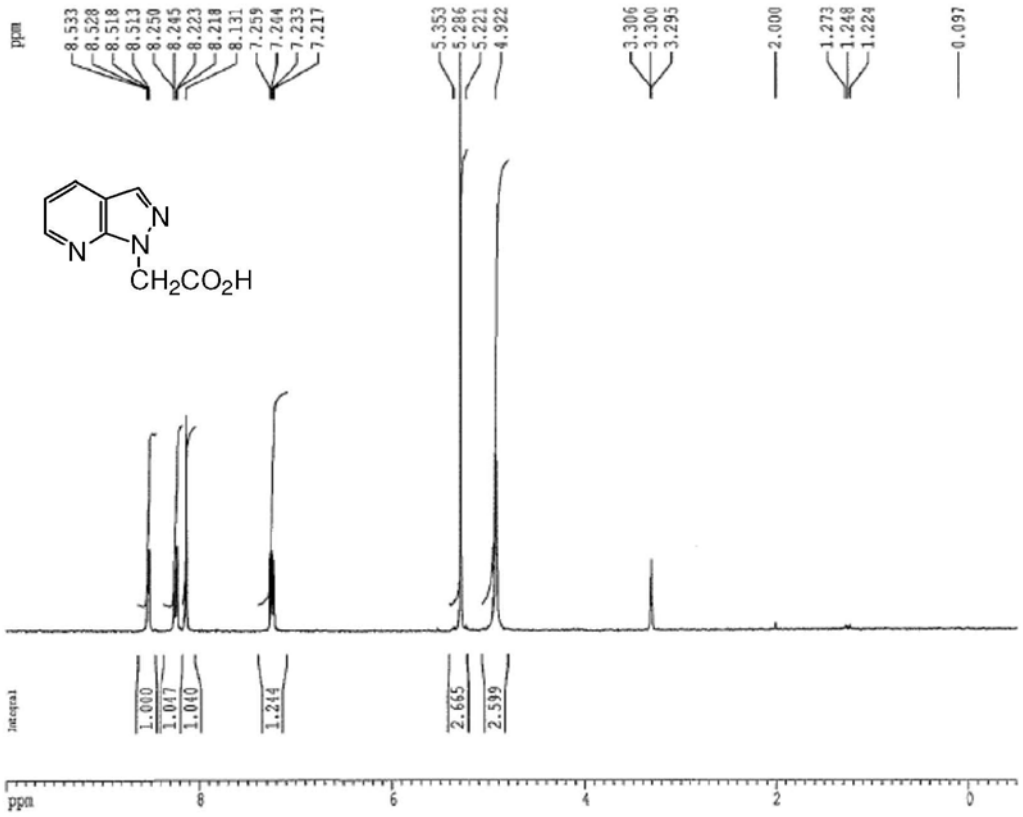

Figure S7. ^{1}H NMR spectrum (300 MHz, MeOD) of 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetic acid (**5a**).

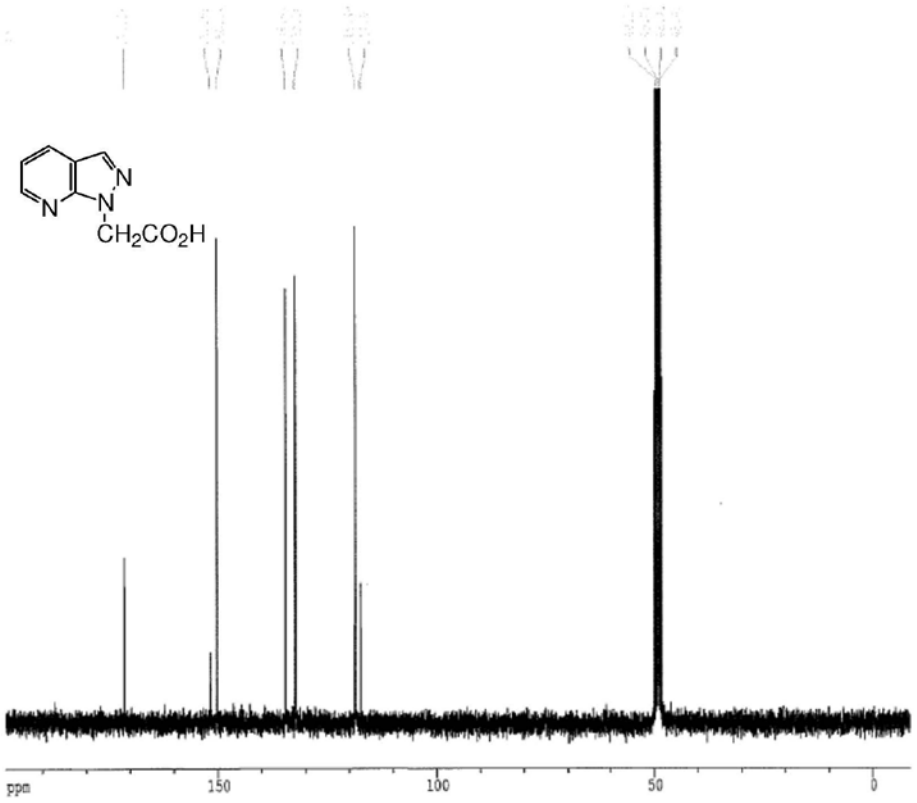

Figure S8. ^{13}C NMR spectrum (75 MHz, MeOD) of 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetic acid (**5a**).

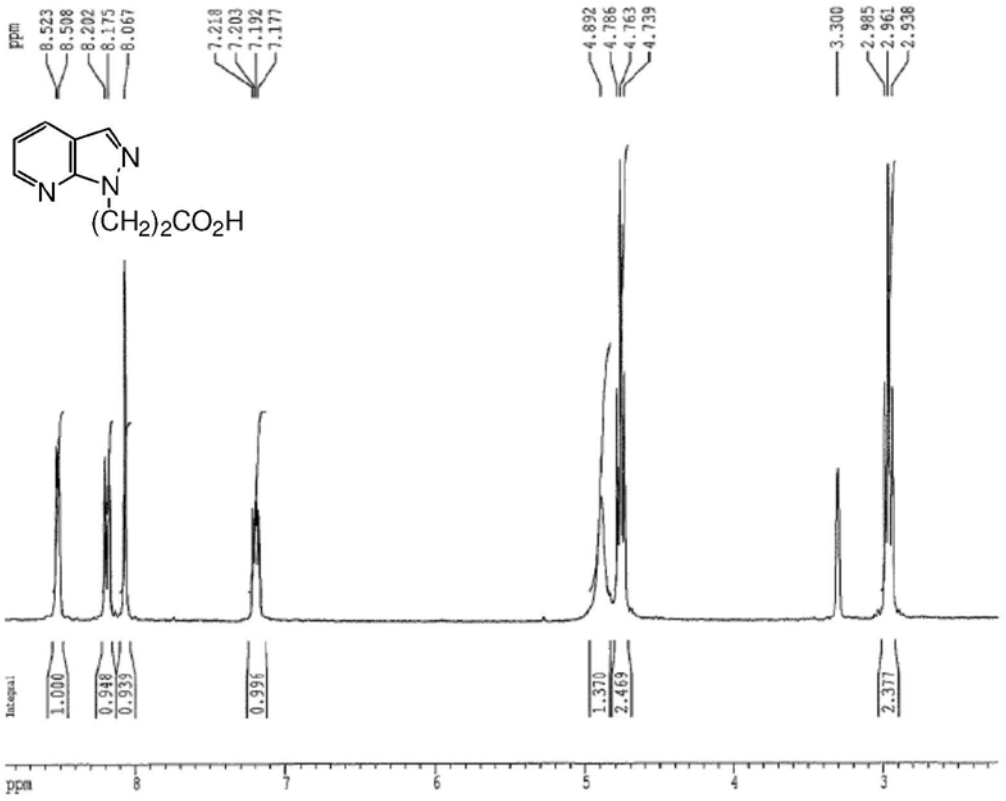

Figure S9. ^{1}H NMR spectrum (300 MHz, MeOD) of 3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propanoic acid (**5b**).

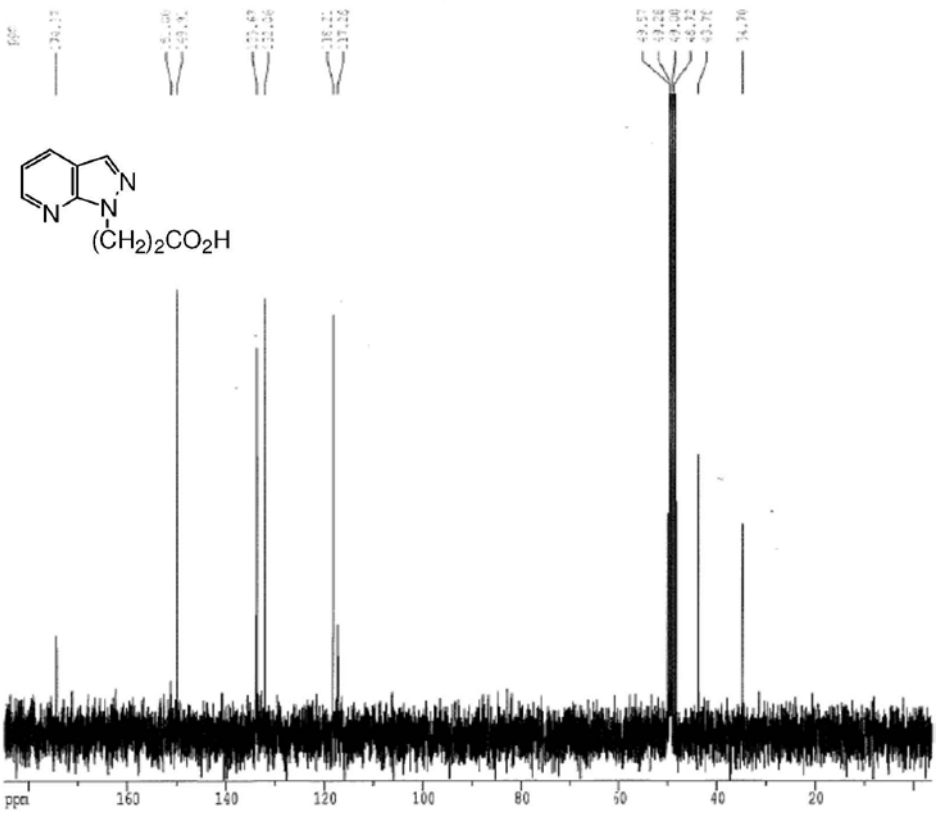

Figure S10. ^{13}C NMR spectrum (75 MHz, MeOD) of 3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propanoic acid (**5b**).

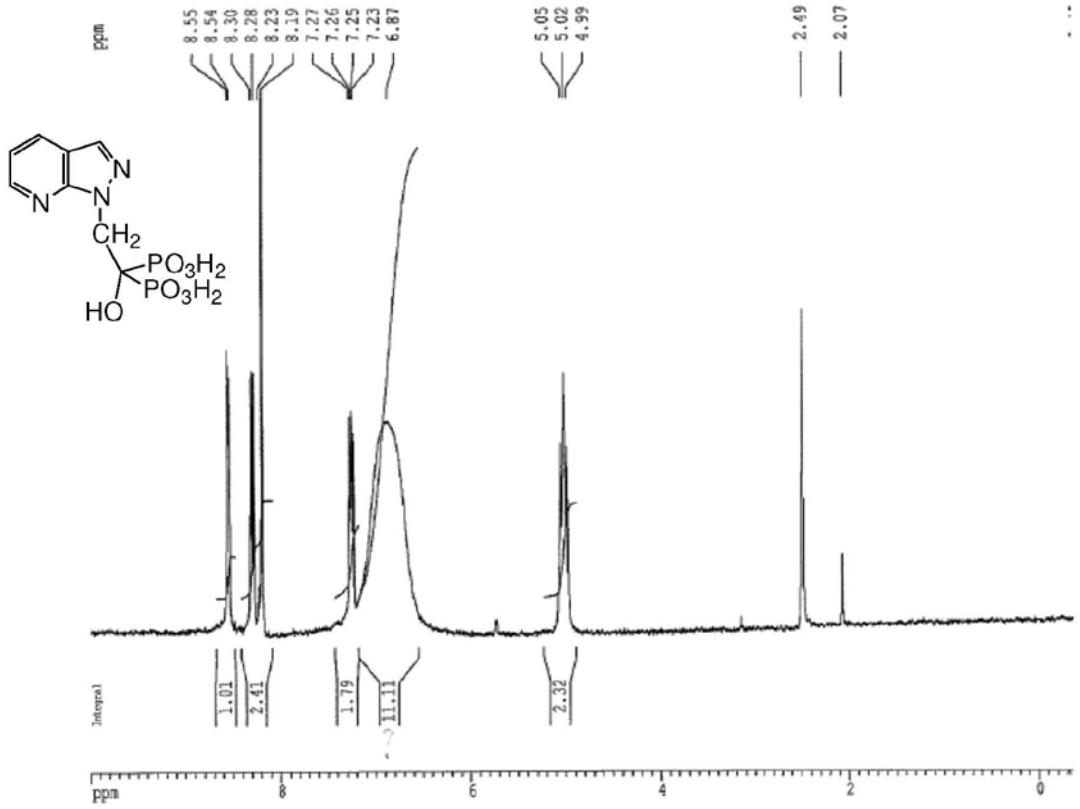

Figure S11. ^{1}H NMR spectrum (300 MHz, DMSO-d_6) of 1-hydroxy-2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)ethane-1,1-diylbis(phosphonic acid) (**7a**).

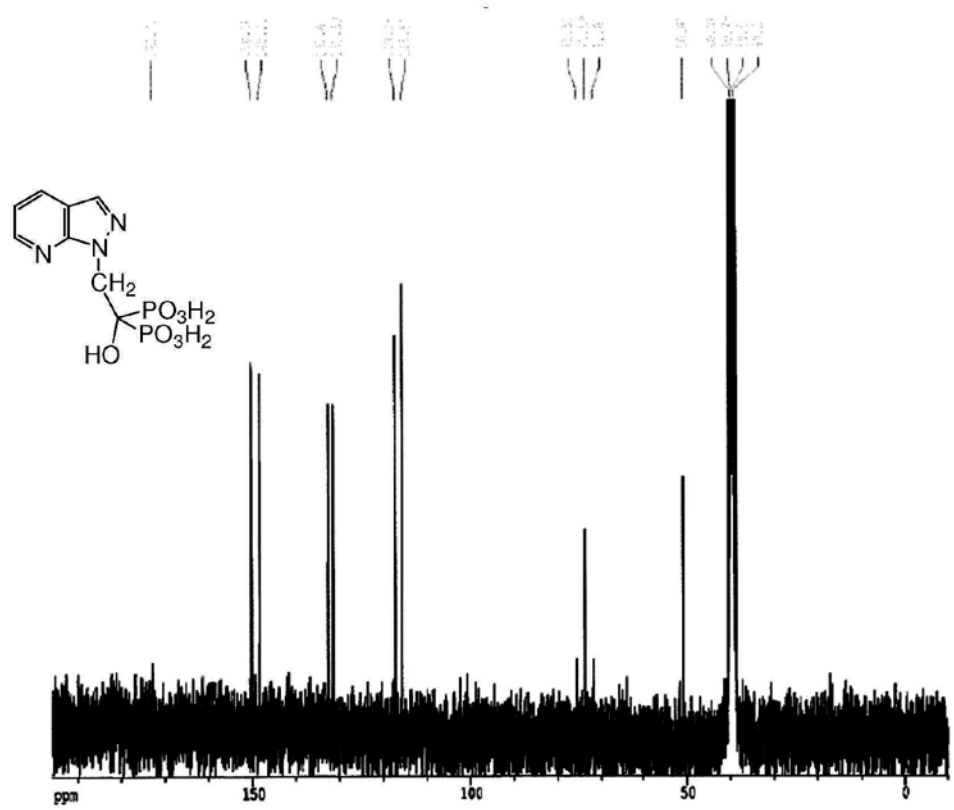

Figure S12. ^{13}C NMR spectrum (75 MHz, DMSO-d_6) of 1-hydroxy-2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)ethane-1,1-diylbis(phosphonic acid) (**7a**).

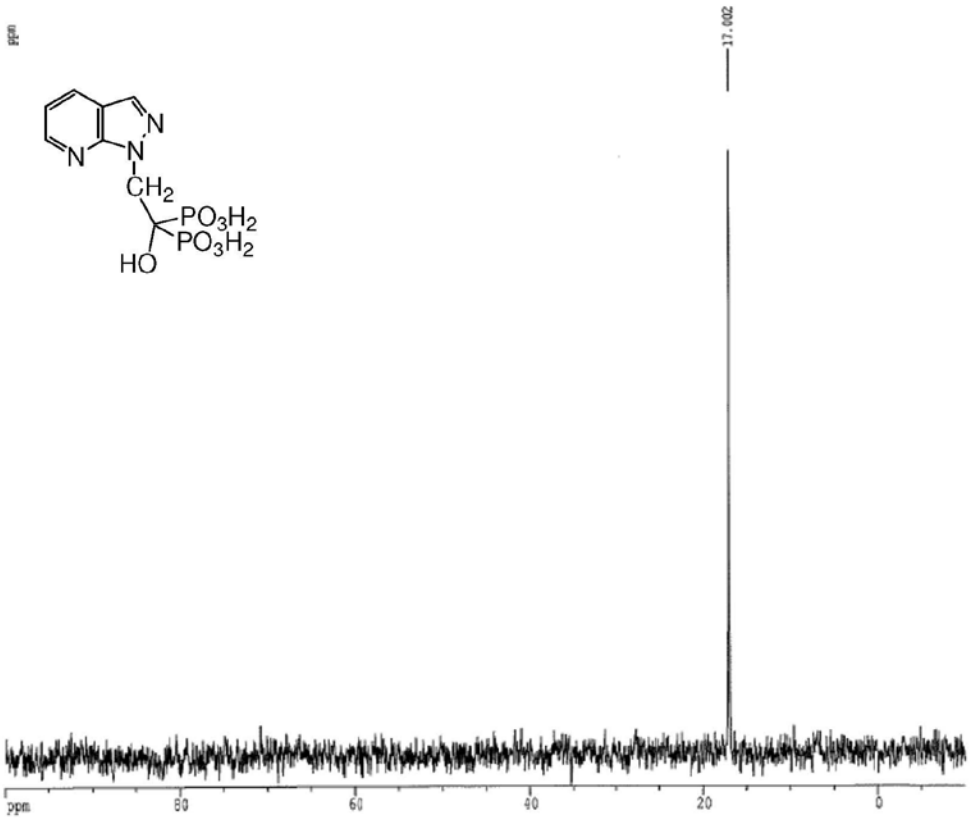

Figure S13. ^{31}P NMR spectrum (121 MHz, H_3PO_4/DMSO-d_6) of 1-hydroxy-2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)ethane-1,1-diylbis(phosphonic acid) (**7a**).

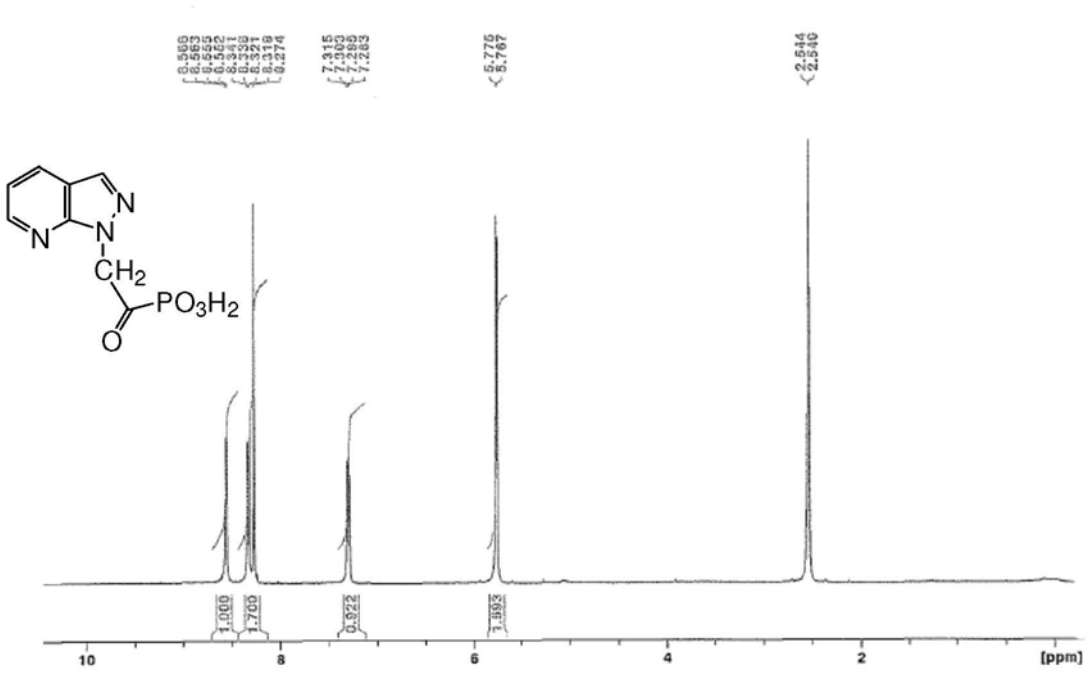

Figure S14. [1]H NMR spectrum (400 MHz, DMSO-d_6) of 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetylphosphonic acid (**8**).

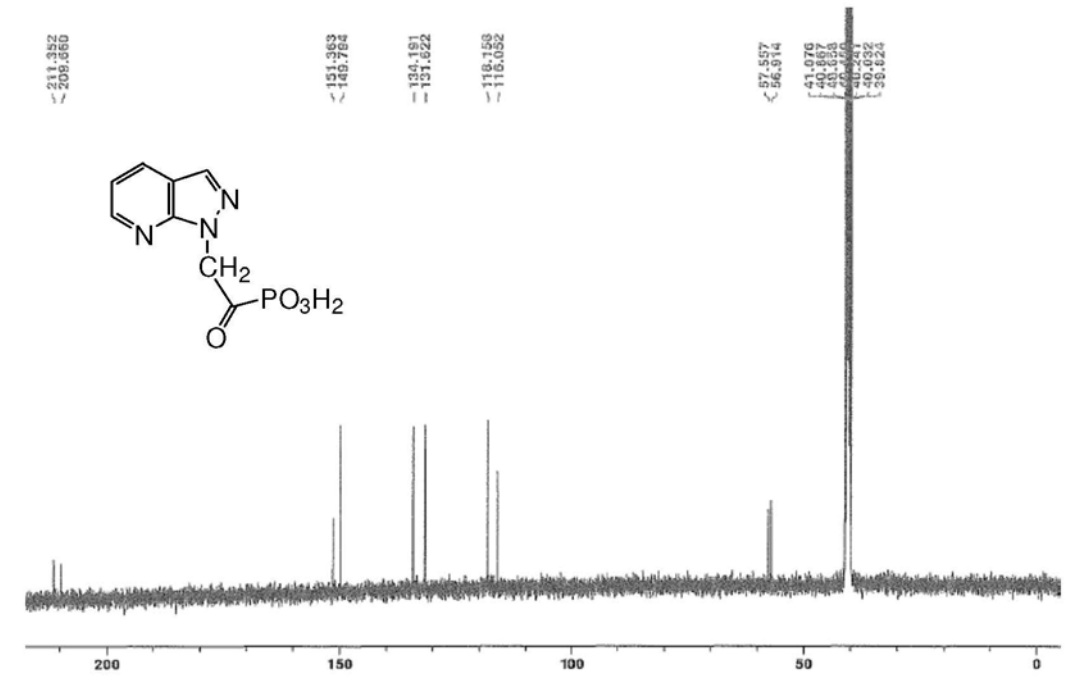

Figure S15. [13]C NMR spectrum (100 MHz, DMSO-d_6) of 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetylphosphonic acid (**8**).

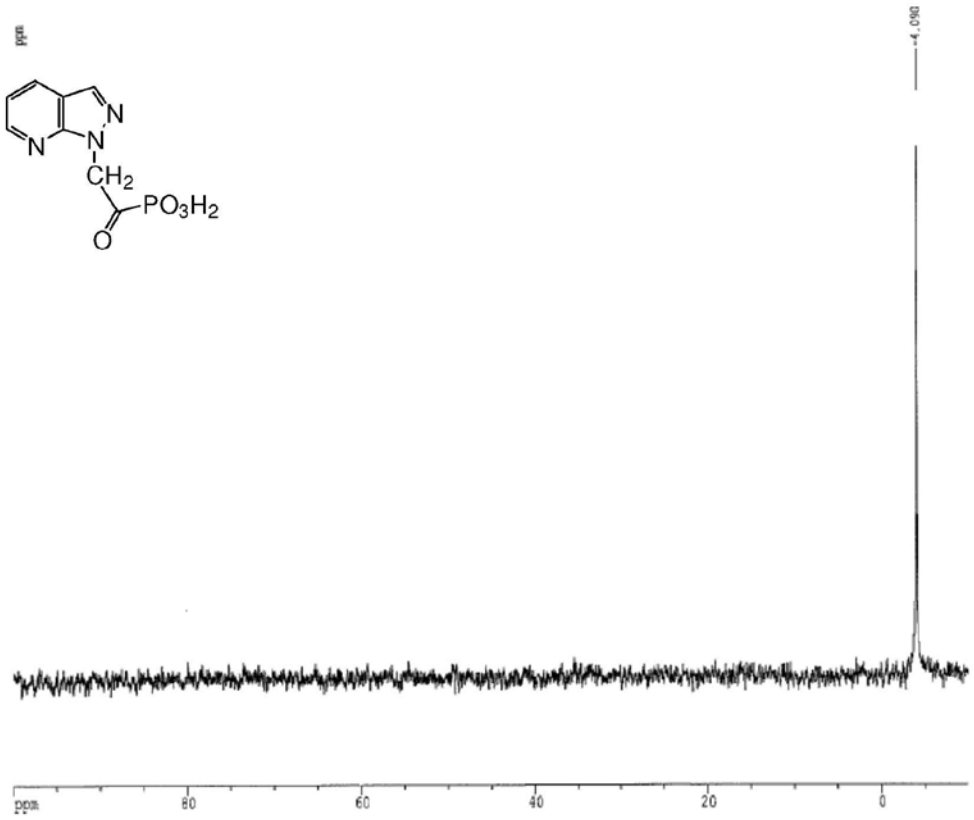

Figure S16. ^{31}P NMR spectrum (121 MHz, H_3PO_4/DMSO-d_6) of 2-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)acetylphosphonic acid (**8**).

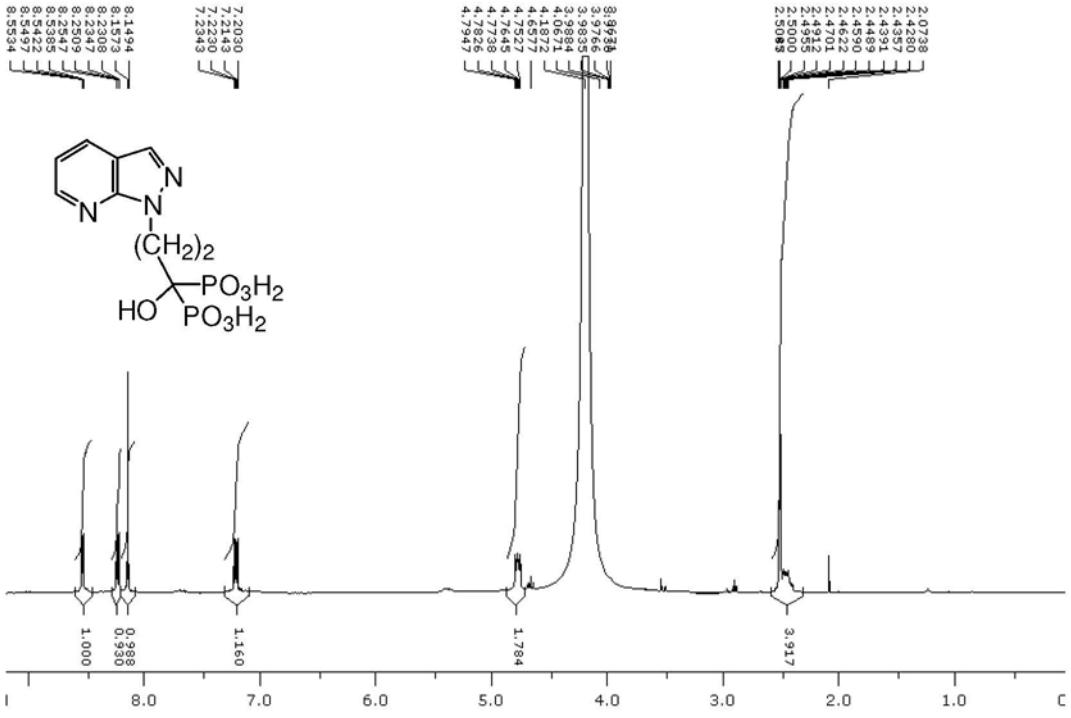

Figure S17. ^{1}H NMR spectrum (400 MHz, DMSO-d_6) of 1-hydroxy-3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propane-1,1-diylbis(phosphonic acid) (**7b**).

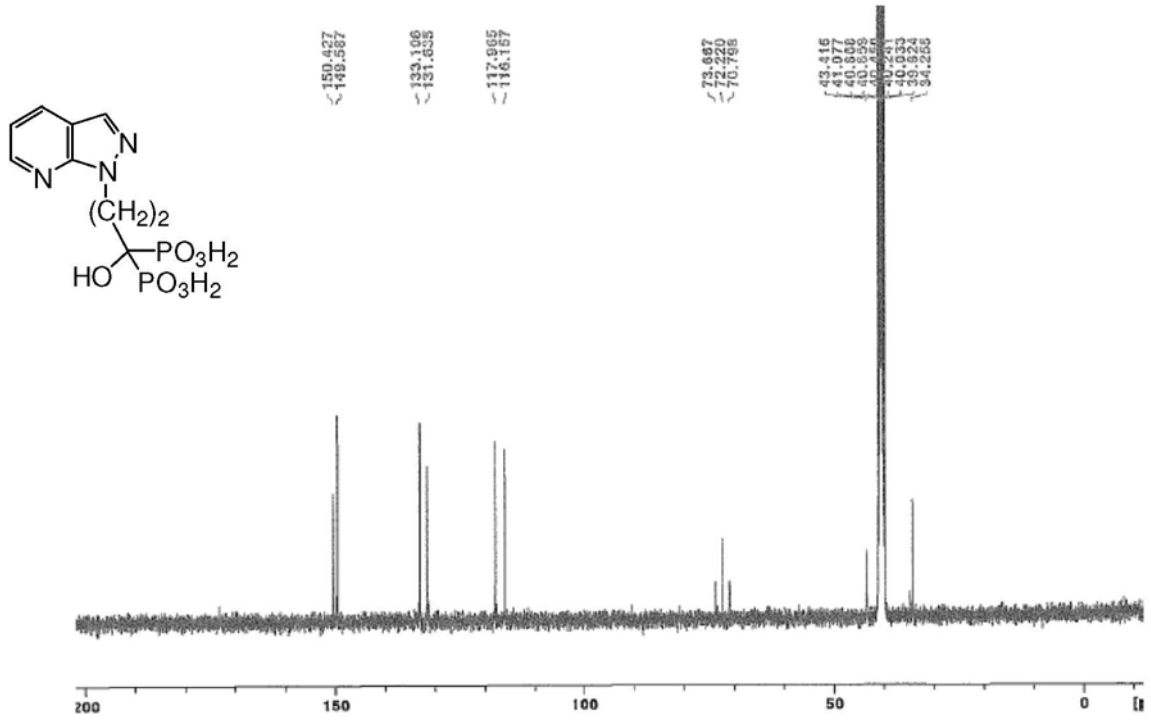

Figure S18. ^{13}C NMR spectrum (100 MHz, DMSO-d_6) of 1-hydroxy-3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propane-1,1- diylbis(phosphonic acid) (**7b**).

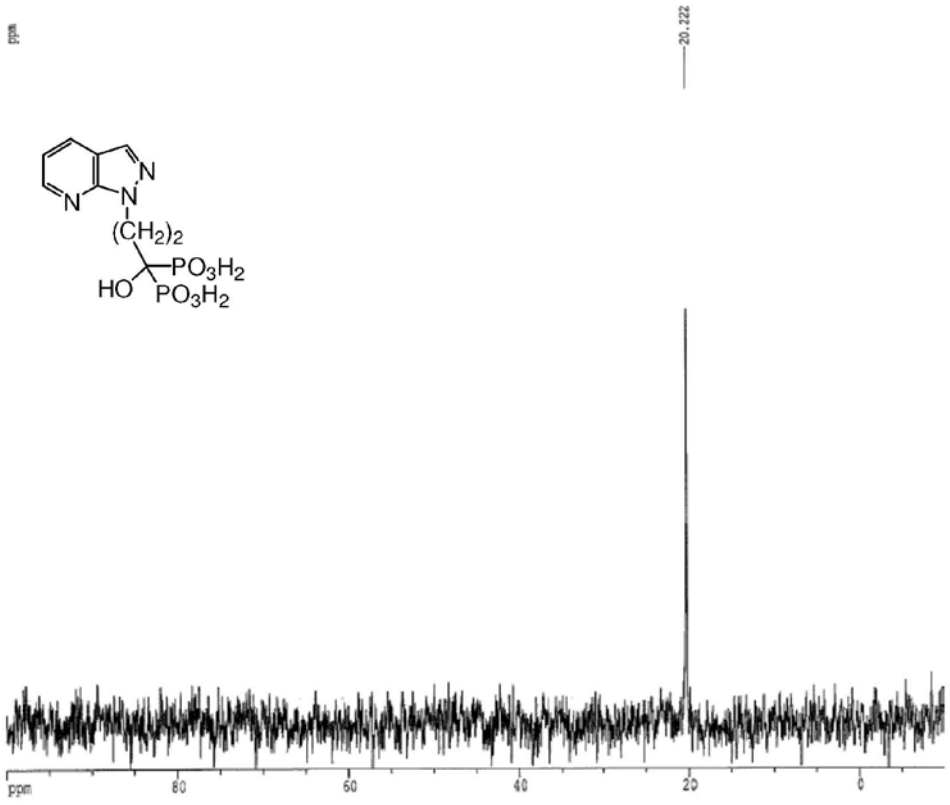

Figure S19. ^{31}P NMR spectrum (121 MHz, H_3PO_4/DMSO-d_6) of hydroxy-3-(1*H*-pyrazolo[3,4-*b*]pyridin-1-yl)propane-1,1- diylbis(phosphonic acid) (**7b**).

Table S1. Crystal data and structure refinement for compound **7a**

Empirical formula	$C_{16}H_{26}N_6O_{16}P_4$
Formula weight	682.31
Temperature	150(2) K
Wavelength	0.71073 Å
Crystal system, space group	monoclinic, C2/c
Unit cell dimensions	a = 11.5429(5) Å, α = 90.00º b = 15.1120(5) Å, β = 92.420 (10)º c = 15.2960(7) Å, γ = 90.00º
Volume	2598.69(18) A^3
Z, Calculated density	4, 1.744 mg m^{-3}
Absorption coefficient	0.381 mm^{-1}
F(000)	1408
Crystal size	0.22 × 0.16 × 0.08 mm
Theta range for data collection	2.42º to 29.74º
Limiting indices	−16 ≤ h ≤ 16, −18 ≤ k ≤ 20, −21 ≤ l ≤ 21
Reflections collected / unique	12655 / 3680 [R(int) = 0.0689]
Completeness to theta = 29.74	99.1%
Absorption correction	none
Refinement method	full-matrix least-squares on F^2
Data / restraints / parameters	3680 / 0 / 203
Goodness-of-fit on F^2	1.073
Final R indices [I > 2sigma(I)]	R_1 = 0.0461, wR_2 = 0.1144
R indices (all data)	R_1 = 0.0673, wR_2 = 0.1228